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Foundrymen's Convention in Toronto

39th Annual Convention—Will Be Held August 20-23, 1935, Hotel Royal York, Toronto, Canada

THE program below, listing the sessions and papers for the 39th Annual Convention of the American Foundrymen's Association, to be held in Toronto, Canada, August 20 to 23, presents a group of papers which should prove of unusual value to the foundry industry.

Of general interest to all classes of foundries, the outstanding session will be that on industrial health hazards and employer responsibilities. Two of the foremost authorities on such problems will present discussion at this meeting. These speakers will be **Dr. W. J. McConnell,** Assistant Medical Director and Director, Industrial Health Section, Metropolitan Life Insurance Company, New York City, and **Donald L. Cummings,** Assistant Director, Saranac Laboratories, Saranac Lake, New York. These two speakers are outstanding among a group of workers who have made a special study of industrial health programs, especially as related to the question of dust conditions and in their talks will give very practical views as to the part of the foundry executive in caring for the health of his workers. This session will be supplemented by a second meeting at which the engineering aspects of dust collection will be surveyed by **S. D. Moxley** of the American Cast Iron Pipe Company, Birmingham, Ala.

Another subject of timely interest for the foundry executive will be that on Apprentice Training and for this session two able speakers have been secured. These speakers, **J. E. Goss,** Employment Manager, Brown & Sharpe Manufacturing Company, and **V. E. Hydar,** Director of Personnel, Falk Corporation, are connected with firms which have made outstanding successes of their apprentice training endeavors. These speakers have been actively connected with the direction and development of the apprentice training work of their firms and they will have real practical information to present on this topic.

Foundry Materials Handling, Refractories, and Sand Research will be the topics of three other general interest sessions.

Shop Operation Courses

While those interested in the more practical shop operation phases of foundry operation will find much to attract their attention in the regular technical sessions, two shop operation courses have been arranged for their special interest. These two courses, each consisting of three sessions, will be on foundry sand control and iron foundry melting. The Sand Shop Course will cover New Sand Qualities, Natural Sand Uses, and the Application of Synthetic Sands.

Round Table Luncheons

Thursday afternoon of convention week has been assigned to round table luncheon conferences, these covering the four major branches of cast metals.

For the non-ferrous foundrymen, their conference will be devoted to a discussion of examples of castings which have presented problems in overcoming defects which occurred during production. Photographs showing molding methods, gates and risers,

will be shown by means of lantern slides. **Harold J. Roast**, Canadian Bronze Company, Ltd., Montreal, Chairman of the Non-ferrous Division Committee in charge of this conference, has worked up the details in such a manner that those attending will find the meeting extremely worth while.

The papers for the regular technical sessions, as will be seen from a study of the program, cover a wide range of topics and their data on recent investigations and practices will record in published form much valuable material for study by those who are alive to the necessity for continual improvement of cast products to meet the competition of other engineering materials.

Provisional Program—General and Non-Ferrous Sessions

Monday, August 19

Committee Meetings.

Tuesday, August 20

10 A. M. to 11 A. M. (1) OPEN MEETING.
Presiding—President **D. M. Avey.**
Formal Convening of 39th Annual Convention.
Address of Welcome, by **L. L. Anthes**, Chairman, Toronto Foundry Committee.
Response.
President's Address.
Report of Officers.

11 A. M. to 1 P. M. (3) FOUNDRY SAND RESEARCH.
Chairman—**H. B. Hanley**, American Laundry Machinery Company, Rochester, N. Y.
The Expansion and Contraction of Molding Sand Under Elevated Temperatures, by H. W. Dietert, H. W. Dietert Co., Detroit, Mich.

Reports of Committees:

Committee on Tests.
Committee on Durability.
Committee on Fineness.

Afternoon. **Plant Visitation.**

8 P. M. to 9 P. M. (4) SAND SHOP COURSE (SESSION 1)
New Sand Qualities
Chairman—**Neil I. MacArthur,** Great Lakes Foundry Sand Company, Detroit, Mich.
Discussion Leader—**George F. Pettinos,** George F. Pettinos, Inc., Philadelphia, Pa.

8 P. M. to 10 P. M. (6) REFRACTORIES.
Chairman—**A. M. Ondreyco,** Meehanite Metals Corporation, Pittsburgh, Pa.
Some Uses of Insulating Refractories in Modern Foundry Practice, by **C. L. Norton,** Babcock & Wilcox Company, New York, N. Y.

Wednesday, August 21

9 A. M. to 11 A. M. (8) MATERIALS HANDLING and FOUNDRY EQUIPMENT.
Chairman—**James Thomson,** Continental Roll & Steel Foundry Company, East Chicago, Ind.
Vice Chairman—**Pat Dwyer,** The Foundry, Cleveland, Ohio.
Mechanical Charging for Small Tonnage Foundries, by **D. J. Reese,** Whiting Corporation, Harvey, Ill.
Mechanical Handling of Sand and Castings for Small Tonnage Plants, by **E. W. Beach,** Campbell, Wyant & Cannon Foundry Company, Muskegon, Mich.

11 A. M. to 1 P. M. (10) OPEN MEETING of FOUNDRY COST COMMITTEE.
Chairman—**Sam Tour,** Lucius Pitkin, Inc., New York, New York.

Afternoon. **Plant Visitation.**

8 P. M. to 10 P. M. (11) INDUSTRIAL HEALTH HAZARDS and EMPLOYER RESPONSIBILITY.
Chairman—President **D. M. Avey,** The Foundry, Cleveland, Ohio.
Dr. Wm. J. McConnell, Assistant Medical Director and Director, Industrial Health Section. Metropolitan Life Insurance Company, New York, New York.
Donald L. Cummings, Assistant Director, Saranac Laboratories, Saranac Lake, N. Y.

8 P. M. to 9 P. M. (13) SAND SHOP COURSE (SESSION 2)
Chairman—**H. W. Dietert,** H. W. Dietert Company, Detroit, Mich.
Discussion Leader—**Horace Deane**, John Deere Co., Moline, Ill.
Foundry Sand Problems Where Natural Sands are Used.

Thursday, August 22

9 A. M. to 10 A. M. (14) SAND SHOP COURSE (SESSION 3)
Discussion Leader—**R. F. Harrington,** Hunt-Spiller Manufacturing Corporation, Boston, Mass.
SYNTHETIC SANDS

9 A. M. to 11 A. M. (16) APPRENTICE TRAINING.
Fifteen Years of Foundry Apprenticeship at the Falk Corp., by **Victor Hydar,** Director of Personnel, Falk Corporation, Milwaukee, Wis.
Some Suggestions for Starting and Carrying Out a Foundry Apprenticeship System, by **J. E. Goss,** Employment Manager, Brown & Sharpe Mfg. Co., Providence, R. I.

9 A. M. to 11 A. M. (17) NON-FERROUS.
Chairman—**Jerome Strauss,** Vanadium Corporation of America, Bridgeville, Pa.
Third Annual Conference on Deoxidation and Degasification of Non-ferrous Metals.
Annual Business Meeting, Non-ferrous Division.

1:15 to 3:45 P. M. ROUND TABLE LUNCHEON CONFERENCE:
Non-ferrous—Chairman, **H. J. Roast,** Canadian Bronze Co., Ltd., Montreal, P. Q., Canada.

4 P. M. ANNUAL BUSINESS MEETING.

7 P. M. ANNUAL DINNER.

Friday, August 23

11 A. M. to 1 P. M. (22) DUST CONTROL and SAFETY CODES.
Chairman—**E. W. Beach,** Campbell, Wyant and Cannon Foundry Company, Muskegon, Mich.
Dust Collection Equipment, by **S. D. Moxley,** American Cast Iron Pipe Co., Birmingham, Ala.

Report on Safety Codes of American Standards Association.

11 A. M. to 1 P. M. (23) NON-FERROUS.

Chairman—**James L. Wick, Jr.,** Falcon Bronze Company, Youngstown, Ohio.

Founding of Magnesium Alloys, by **Dr. J. A. Gann** and **M. E. Brooks,** Dow Chemical Co., Midland, Mich.

High Strength Non-ferrous Casting Alloys, by **A. J. Murphy,** J. Stone & Company, Ltd., Deptford, London. (Exchange paper submitted on behalf of the Institute of British Foundrymen.)

Report of Committee on Analysis of Defects, by **H. M. St. John,** Detroit Lubricator Co., Detroit, Mich.

Afternoon. CANADIAN NATIONAL EXPOSITION.

Treating Britannia Metal

Q.—Will you please furnish us with a formula for a Britannia casting metal, suitable for slush or hollow castings; also a mixture of Britannia metal suitable for solid castings, mounts, etc.

We will also appreciate it if you will advise us if there is a standard method for hardening or tempering sheet Britannia metal, and what is the accepted practice? Of course, you will understand Britannia metal carries a high content of tin and it is soft metal; at the same time, there is a method of treating same (some call it tempering and some call it hardening), which we understand is accomplished by putting the sheets or blanks on a steam plate and bringing up to a certain temperature, and this operation or process actually hardens the metal so there is a slight spring. In other words, as we understand it, it puts "life" into the metal.

A.—It has been suggested to us by one authority that in order to avoid your difficulty the copper content of the Britannia metal be reduced to 1% or less. We have also had recommended to us, the composition 95 tin 5 antimony.

One method of heat treating spun Britannia metal articles is to hold them at about 400 deg. F. for 90 minutes and then cool in the open air.—**Ed.**

Wire Drawing Lubricant

Q.—Kindly advise us if possible about the following. Can pin wire be drawn through six dies in any solution other than yeast and bran such as is now being used? We wish to avoid the smell the above dyes causes.

A.—The necessary lubricating and cooling qualities in "dips" used on the modern high speed wire drawing machines for small wire, seem to be associated with unpleasant odors and other disagreeable features in ratio to their effectiveness. For years a dip made of soap and water, 6 lbs. soap to 50 gallons water, was used.

The success of any dip depends largely upon the condition of the wire to be drawn; uniform temper, cleanliness, die condition, etc. A wide range of dips has been developed by wire drawers. We would suggest consulting the makers of your drawing machines as to the effectiveness of other dips to meet your needs.—**W. J. Pettis.**

Oxidized Bronze

Q.—We are forwarding you by parcel post under separate cover a sample cut from a bushing weighing about 40 pounds. The alloy from which this sample was cast consists of copper 87%, tin 5%, lead 3%, zinc 2%, and 3% of copper nickel 50-50. You will note that this casting shows porosity next to the core. In your opinion is this condition due to the alloy, or is the core at fault? We recast these bushings under the same conditions with an alloy of 88% copper, 10% tin, 2% zinc. The castings from this alloy were very satisfactory.

The sample we are forwarding you is cast from metal that was remelted, that is, when the first metal was unsatisfactory we were of the opinion that by remelting the metal the condition would be improved. On the contrary we found that the porosity was increased. Any advice you may be in position to offer will be greatly appreciated.

A.—We received the sample cut from bushing. On examination we find this metal very badly oxidized, and the gas in the metal stays where it finds the most heat, which in this case is next to the core, trying to escape.

To eliminate this trouble we suggest you add 8 ounces of 15% phosphor-copper per hundred pounds of metal You will deoxidize your metal and overcome your trouble. You have proven in your own test that the trouble is not the core, as 88-10-2 castings are satisfactory.

This metal has been oxidized in some manner, possibly in the method of handling in melting or in the class of material used. At any rate, the phosphor-copper will help you considerably.—**W. J. Reardon.**

Discolored Copper

Q.—We electrically anneal copper tubing. It is cooled in hot water. We secure a nice clean bright finish, but as it is exposed to the atmosphere it discolors continually until it becomes quite dull in finish.

Would appreciate it very much if you or some of your people would advise how we can overcome the discoloring, as it is quite necessary that the material retains a bright shiny finish.

A.—In the May, 1935, issue of the **Metal Industry,** under the heading of "Electric Bright Annealing," is an article describing the apparently successful treatment of this problem; no water contact is used in cooling.

In any treatment of the non-ferrous metals, or their alloys, where the hot water bath is used, either to facilitate quick drying, or to prevent oxidization when removed from the furnace, unless the metal is subjected to reprocessing, (or, if the finish is "soft," and in such form as to admit of a slight surface abrasion, i. e. wiping, or dry sawdust treatment) the discoloring generally follows; probably due to some deleterious element in the water.

We would suggest, if a cooling chamber in connection with your furnace is not practical to try out, that you take one length of copper tubing and dry it in sawdust as soon as it is removed from the water; this may reduce or eliminate the discoloration.—
W. J. Pettis.

High Purity Ingot Metal

By WILLIAM E. McCULLOUGH

Chief Metallurgist, Bohn Aluminum and Brass Corporation, Detroit, Mich.

Bohn Employs Spectrograph to Reach New Standards of Non-Ferrous Ingot Purity

IN ORDER definitely to raise the standards of purity and accuracy of analysis of its non-ferrous ingots, the Michigan Smelting and Refining Company, of Detroit, Mich., a subsidiary of Bohn Aluminum & Brass Corporation is supplanting, in many instances, chemical methods of analysis and is using in its place the spectrograph. This marks a radical departure in the use of this instrument which up to this time has been found mainly in scientific laboratories where the ultimate in precision measurement is required. The Bohn company now uses the spectrograph as an instrument of every day use in the control of ingot production and has found as a result a very satisfactory gain in quality and accuracy of analysis.

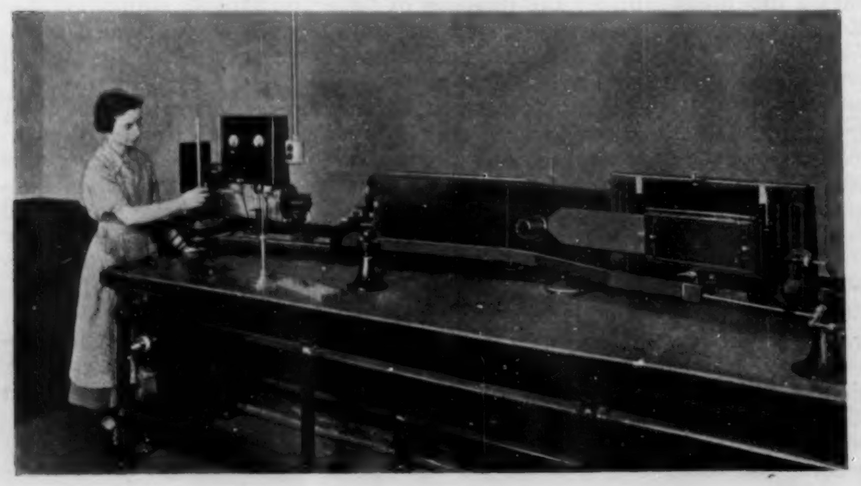
Commonly regarded as a purely research instrument, to be found mainly in the scientific laboratories where the ultimate in precision measurements is the order of the day, the spectrograph has become an instrument of every day use in the control of production for the Bohn Aluminum & Brass Corporation.

For those not acquainted with this instrument, the spectrograph is a photographic means of analyzing a substance for the elements of which it is composed. Both qualitative and quantitative analysis may be accomplished very rapidly by use of the spectrograph. It is particularly suitable for quantitative analysis of those elements which are present in very small percentages, and for this purpose is found to be more accurate than chemical analysis.

The essential parts of a spectrograph consist of a slit, prism, collimating lens for focusing parallel light on the prism, and a camera lens for focusing the light emerging from the prism on the photographic plate. The prism has the power to resolve or break up the light passing through it into its various wave lengths, which make up its characteristic spectrum. Now, every element when either burned in a flame or volatilized in an electric arc or spark emits light, which when passed through a prism is broken up to form its characteristic spectrum, by which that element may be definitely identified. When a material, for example, an alloy consisting of copper, zinc, and tin is burned in an arc, a composite spectrum is formed, in which the spectrum of each of the separate elements will be found.

Since the majority of the sensitive spectral lines lie in the ultra violet or "invisible" portion of the spectrum, it is necessary to use an instrument having quartz optical parts, because ordinary glass does not transmit ultra violet light. Fortunately, though not visible to the eye, the ultra violet portion of the spectrum can be photographed, in the same manner as "visible" light. The observations in this "invisible" region are, therefore, made by photography, and the photographic record, called a spectrogram, is then examined for the results. The photographic plate thus serves as a permanent record of the spectrographic analysis.

The principle of quantitative analysis by the spectro-



Dr. Frances Lamb, formerly of the Department of Physical Chemistry, Michigan State College, who operates the spectrographic equipment in the inspection department of the Michigan Smelting and Refining Company, a subsidiary of the Bohn Aluminum & Brass Corporation. The spectrograph shown here is now used for routine inspection of nonferrous metals manufactured for a wide range of purposes by the Bohn company.

graph is based upon the fact that, the higher the per cent of the element present, the more intense are the sensitive spectral lines of that element. This is clearly seen in Plate I, which shows the spectra of cadmium having increasing percentages of lead. It will be noted that the lead line having a wave length of 2614.20 Angstrom Units gradually increases in intensity as the per cent of lead increases. This spectrogram and those that follow were taken on a Bausch & Lomb Medium Quartz Spectrograph installed in the Bohn Corporation's laboratories.

Although it is only recently that the vital importance of spectrographic analysis in industry has been realized, the Bohn Corporation has made limited use of this method of control for some time. New alloys have been developed for a variety of uses in recent years—these could not be manufactured if the spectrograph did not provide the close control necessary for their production.

The Bohn Corporation in response to a demand for automotive bearings having a hardness greater than that of babbitt under high temperatures, has developed a cadmium-base bearing alloy to meet the temperature and load requirements encountered.

Very small amounts of tin in a cadmium base bearing alloy would be detrimental to the successful operation of such a bearing according to **William E. McCullough,** Chief Metallurgist. By means of the spectrograph they can rapidly check the presence of any tin present in the alloy and if so, to what extent. Any chemical analysis directed at the same end and to somewhere around the same accuracy would be extremely tedious. With a high rate of production, rapidity as well as accuracy of checking is an absolute necessity.

It is extremely difficult even to approach the accuracy of quantitative spectrographic analysis by chemical methods and furthermore, the latter method is also more expensive in such cases.

Plate 2 is a spectrogram illustrating an examination of cadmium base bearing alloys for presence of tin. It will be noted that samples 2 and 3 are absolutely free from tin, while sample 1 and 4 are too high in tin content and could not be used. In addition, a study of the spectra shows that sample 4 is contaminated with nickel and zinc, and sample 1 with nickel. Such an examination serves as a very rapid check on the presence of undesirable elements.

Not only in the field of the manufacture of bearings has the spectrograph proved its value but also in the production of other alloys. To quote merely one example;—the manganese content of German silver extrusion billets is maintained between the limits .10-.20% and Plate 3 represents a typical control analysis obtained, as a check on the quantity of this element present. The lower set of four spectra are standards having 0.03, 0.10, 0.15 and 0.25% manganese. The upper eight spectra are samples 1, 2, 3, 4 in duplicate. It is clearly evident from a comparison of the intensities of the sensitive spectral lines of manganese in the samples with those of the standards, that sample 2 is the only one outside the required specifications.

Further, all supplies of so-called "secondary" metals are checked to see that they contain no harmful impurities. A chemical analysis to determine all the possible impurities would obviously be very tedious.

Some of the more recent specifications covering wrought aluminum alloys for the aircraft and building industries and aluminum castings for Government use stipulate such low maximum percentages of certain impurities that their determination in a chemical laboratory would require too much time and expense to be commercial. Here, again, spectrographic analysis are relied upon for quick and accurate determination of the very small amounts of the various impurities that are present. When it is realized that these impurities are frequently present originally in the virgin metal in very small amounts, another obvious application of the spectrograph is the examination of samples representing immense tonnages of virgin copper, zinc, lead, aluminum, and tin that are purchased annually by the Bohn Aluminum & Brass Corporation from both domestic and foreign sources.

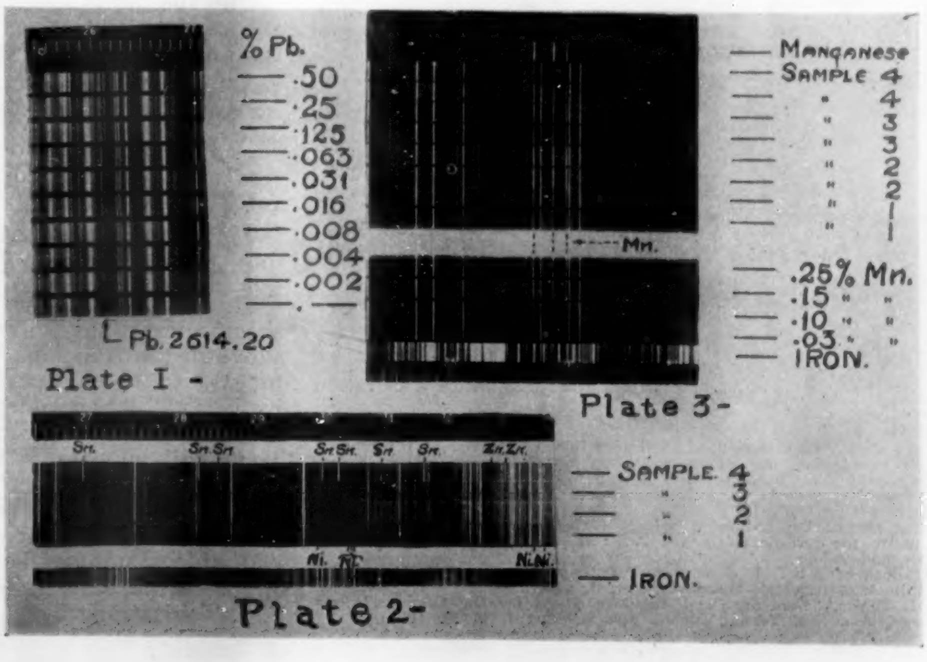


PLATE 1—Spectra of Cadmium with lead content increasing from 0.000 to 0.50%.

PLATE 2—Examination of four samples of cadmium base bearing alloys for tin.

PLATE 3—Typical control analysis of German silver extrusion billets for manganese.

Die Casting Alloy Standards

Proposed Tentative Specifications for Lead and Tin-Base Alloy Die Castings[1]. A. S. T. M. Designation: B—35 T

THIS is a **Tentative Standard** and under the Regulations of the Society is subject to annual revision. Suggestions for revision should be addressed to the Headquarters of the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Issued, 1935.

Scope

1. These specifications cover die castings made by pressure casting from the following alloys: tin-base, lead-base and intermediate. Five typical alloys are specified and are designated as Grades Nos. 1 to 5, in order of decreasing tin content.

Chemical Composition

2. The alloys shall conform to the following requirements as to chemical composition, within the limits specified in Section 3:

Alloy Grade	Tin, per cent	Antimony, per cent	Lead, per cent	Copper, per cent	Iron, max., per cent	Arsenic, max., per cent.	Zinc, max., per cent	Aluminum, max., per cent
No. 1[b]	91	4.5	0.35[a]	4.5	0.08	0.08	0.01	0.01
No. 2	83	12	0.35[a]	5	0.08	0.08	0.01	0.01
No. 3[b]	65	15	18	2	0.08	0.15	0.01	0.01
No. 4[b]	5	15	80	0.50[a]	....	0.15	0.01	0.01
No. 5[b]	..	10	90	0.50[a]	....	0.15	0.01	0.01

Permissible Variations

3. The following permissible variations in the percentages of the desired elements specified in Section 2 will be allowed, but shall not apply to the maximum percentages of impurities specified:

Percentage of Element Specified	Permissible Variations Over or Under The Specified Value, Units of Per Cent
Not over 2 per cent	0.25
Over 2 to 5 per cent, incl.	0.50
Over 5 to 10 per cent, incl.	0.75
Over 10 per cent	1.00

Sampling

4. Samples for chemical analysis may be taken either by sawing, drilling or milling a representative group of castings, and shall represent the average cross-section of the material. The castings and cutter shall be thoroughly cleaned and no lubricant shall be used during the operations.

Chemical Analysis

5. Chemical analysis shall be made in accordance with the Standard Methods of Chemical Analysis of Alloys of Lead, Tin, Antimony and Copper (A.S.T.M. Designation: B 18) of the American Society for Testing Materials.[2]

Density

6. The die castings shall weigh not less than a minimum agreed upon by the manufacturer and purchaser for the individual order.

Soundness

7. Heavy section die castings are subject to spongy centers. The extent of the sponginess, if objectionable, shall be mutually agreed upon by the manufacturer and purchaser for each individual casting.

Finish

8. The die casting shall be produced free from cracks and other disfiguring blemishes.

Permissible Variations in Dimensions

9. Permissible variations in dimensions shall be within the limits specified on the drawings describing the casting or castings on order, or shall be within the limits specified in the order.

Rejection

10. Die castings which show injurious defects revealed by machining operations subsequent to acceptance may be rejected, and if rejected the manufacturer's responsibility shall be limited to replacing rejected parts without charge to the purchaser.

Appendix

Physical test data do not constitute a part of these specifications but will be found for most of these alloys in the Appendix to the Standard Specifications for White Metal Bearing Alloys (Known Commercially as "Babbitt Metal") (A.S.T.M. Designation: B 23) of the American Society for Testing Materials[3]. They will indicate to the purchaser the mechanical properties that may be expected of these alloys. It is to be understood that there may not be exact conformity between the properties of the specimens tested and of commercial die castings. Other information on these die castings will be found in a paper by F. J. Tobias[4].

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[a] Maximum.

[b] These alloy grades correspond to Grades Nos. 1, 5, 8 and 12, respectively, of the Standard Specifications for White Metal Bearing Alloys (Known Commercially as "Babbitt Metal") (A.S.T.M. Designation: B23) of the American Society for Testing Materials, see 1933 Book of A.S.T.M. Standards, Part I, p. 841.

[1] Under the standardization procedure of the Society, these specifications are under the jurisdiction of the A.S.T.M. Committee B-6 on Die-Cast Metals and Alloys.

[2] 1933 Book of A.S.T.M. Standards, Part I, p. 822.

[3] 1933 Book of A.S.T.M. Standards, Part I, p. 841.

[4] F. J. Tobias, "Lead-Base and Tin-Base Alloys for Die Castings," Proceedings, Am. Soc. Testing Mats., Vol. 31, Part I, p. 280 (1931).

Free Cutting Aluminum for Screw Machine Work

By L. W. KEMPF and W. A. DEAN
Aluminum Company of America, Cleveland, Ohio

New Alloys Available, Using Lead, Bismuth, Copper and Magnesium*

ONE of the most important characteristics of a good machining metal is its ability to discard scrap quickly. A clean-cutting material does not impede the cutting tool and assures a more accurate cut. In addition, tools retain their sharpness longer because larger entrant angles may be used without diminishing the quality of the surface finish.

Long shavings are not only annoying, but they also retard operation. This is particularly true of the metal used in automatic screw machines, whose speed, many times that of a hand-operated lathe, makes "free cutting" an absolute essential. This is a term coined to denote the rapid breaking up of cut scrap so that it falls away from the machined piece, leaving the metal surface clean and not cluttered, for the oncoming tool.

Aluminum, because of the development of certain alloys, has now been added to the list of metals which the trade terms "free cutting." In order to understand the difficulties which preceded this development, it may be well to sum up the conditions which brought about serviceable free cutting metals.

Tool and Material Development

The present-day automatic screw machine has been greatly improved, both in design and application, over the original screw-cutting machine, first designed only for the production of bolts from continuous lengths of rod. The stationary V dies of the old machine have been replaced by rotating collets and the opening die head has given way to a multitude of tools, some of whose functions are a far cry from the mere cutting of threads.

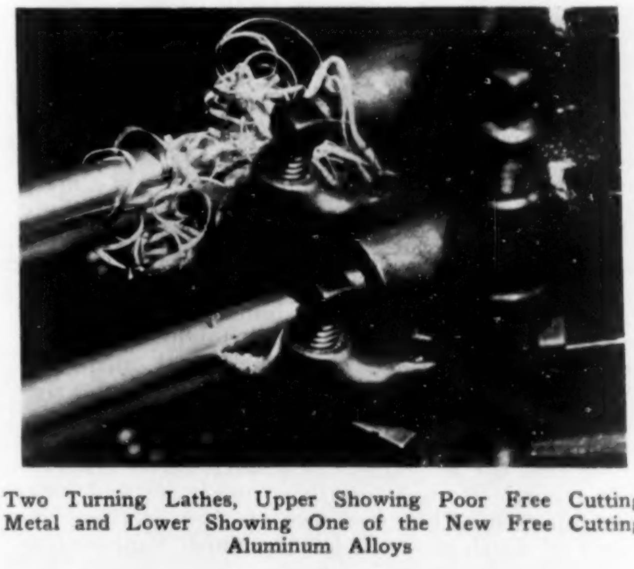
On the original machine the cutting tools were mounted on the main spindle and rotated while the stock was stationary. In the modern machines the spindle carries the work while the tools are either stationary or rotating. There can even be as many as five or six spindles.

The relatively small space in which the products are formed, together with the high speeds used, are reasons for the development of materials for this specific service. It is obvious that chips must be small and must fall away from the tools readily in order to prevent the fouling of both tools and work. In view of the complexity of the tooling, it is essential for economical production that the rate of wear on ordinary cutting materials be sufficiently low that tools need be redressed only infrequently. Also, since the parts are generally in a finished condition as they come from the machine, excellent surface appearance is not only desirable, but necessary.

Leaded Brass

The first of the free cutting metals to be developed was leaded brass screw machine rod, containing about 60 per cent copper, 3 per cent lead, and the rest zinc, a material which has met the requirements of free cutting so well that it has been to no little degree responsible for the present state of the modern screw machine.

High-sulphur, low carbon, cold drawn steel, although much more free cutting than ordinary low carbon steel, is not nearly as satisfactory from the standpoint of machineability as free cutting brass. Here it may be emphasized that the suitability of a material for screw machine production is not necessarily a criterion of its general machineability. Many materials, not particularly adaptable for high speed screw machine production, are eminently satisfactory for general machining operations. Every new type of metallic material is almost immediately appraised as to its adaptability for screw machine production.



Two Turning Lathes, Upper Showing Poor Free Cutting Metal and Lower Showing One of the New Free Cutting Aluminum Alloys

* An account of this development appeared in Metal Progress, the official journal of the American Society for Metals, for July.

A case in point is the recent introduction of relatively free cutting stainless steel.

Aluminum and its Alloys

Commercially pure aluminum is not adaptable for general use in automatic screw machines, but high strength, heat-treated aluminum alloys have, to a considerable degree, the properties desirable for the production of screw machine parts. A technique was developed by the Aluminum Company of America which greatly reduced the difference in machining costs between free cutting brass and heat-treated strong aluminum alloys.

An even more free cutting aluminum alloy has long been needed, however, and a study has been carried on over a number of years to bring about the development of such a material. The success of leaded brass screw machine rod interested aluminum research scientists, but whenever lead was added to aluminum-copper alloys in the experiments the result was failure.

During some of the experiments it was demonstrated that alloys sufficiently high in copper (8 per cent and above) machined fairly well, but these alloys could not be commercially hot rolled to rod because of hot shortness associated with the high alloy content.

The addition of tin in certain concentrations would impart free cutting properties to some of the heat treatable wrought alloys, but it would so impair their hot working characteristics that the economic production of screw machine rod was impractical.

Aluminum-Lead Alloy

Scientific thought, though repulsed, returned again to a consideration of the possibilities of alloying lead and aluminum. In the course of another investigation an occasion arose when molten aluminum was fluxed with various lead salts. Subsequent analysis indicated the presence of lead in such concentration that complete quantitative reduction of the salt and solution of the lead in the liquid metal had taken place. Finally the alloying of metallic lead and aluminum was worked out and the solubility of lead in liquid aluminum established. The new alloys, with sufficient amounts of lead present, were found to be actually free cutting.

A preliminary test to determine the free cutting qualities of the alloys was made by measuring tool wear and the power to remove a unit volume of metal. To examine the chip size and the finish, a lathe tool was used which would give long continuous chips and a relatively poor finish with most wrought aluminum alloys, but at the same time would give small, well broken up chips and a good finish with free cutting brass. Such an arbitrary method of evaluation could not indicate quantitatively the performance of a material in all the variety of operations on a screw machine, and so the new alloy was subjected to actual screw machine operations. The simplified test proved to be accurate. A material which gave fine, well broken chips in the test performed similarly in the screw machine, although marginal alloys might show a reversion to long, stringy chips in critical operations.

Subsequent measurements made by means of a specially adapted Charpy impact machine, a dynamometer tool of the Boston type, and Croft's sawing test, indicated that the chip size was a much better criterion of free cutting properties than power or tool wear measurements. Chip size was also an excellent indicator of finish as well, for the finish improved as the chip size decreased.

Now that the production of free cutting aluminum alloys was an actuality, it was found that the concentration of lead required for satisfactory machineability in the commonly used strong alloys was too high for the practical production of ingots uniform in chemical composition. Even small ingots of fairly uniform composition were difficult to work hot.

Complex Alloys Better

A solution to the problem consisted of the discovery that the simultaneous presence of small concentrations of a multiplicity of elements was much more efficient in producing satisfactory machineability than any one element alone. From a number of elements found to be satisfactory lead and bismuth were chosen to supply the multiplicity because it was further found that these elements had relatively small effect on the other properties of the alloy. The effect of copper on machineability was also kept in mind, and its concentration was placed at about the maximum for the satisfactory hot working of large ingots. This, then, is one of a number of possible alloys having free cutting qualities.

In the T temper, which is the condition of the metal after the application of both solution and precipitation heat treatments, the tensile properties do not differ greatly from those of the duralumin-type alloys or free cutting brass. But in the W temper (solution heat treatment only) the alloy is a relatively soft material of excellent machineability which can be satisfactorily cold worked, while the wide range of mechanical properties offers opportunities for broad application and improved products.

Now that the laboratory tests were successful the problem of how to fabricate this new alloy on large scale production had to be overcome. It must be remembered that the ingot had to be made from an alloy containing considerable quantities of two heavy elements having very low solid solubility in aluminum. But the problems of alloying and casting were overcome, and hot rolling and drawing presented no great difficulty. Soon rod of the new alloy was available in quantity lots at the screw machine works of Aluminum Company of America in Edgewater, New Jersey. Here it was found that the alloy was much more free cutting than the aluminum alloys previously used, and work was initiated to develop a technique to take advantage of the potential economies offered.

Physical Properties of the Free Cutting Aluminum Alloy

The relatively low yield strength of the alloy in the W temper offered the possibility of cold working operations after machining, although at the same time it presented the problem of bending during machining. Deformation and breakage during machining were overcome by slight changes in tool design.

The T temper of the alloy has the advantage of higher yield and shear strengths, but a somewhat lower impact resistance. The relatively low degree of toughness appeared to be responsible for breakage during machining in some set-ups. A careful examination of the alloy in both tempers led to the conclusion that an alloy with a toughness corresponding to an impact resistance of eight to ten foot-pounds and the cutting properties of the alloy in the W temper would make a desirable addition to the free cutting alloy field.

It was found that duralumin-type alloys, which develop their optimum properties on aging at room tem-

perature, are generally tougher for the same tensile strength than alloys which are aged at elevated temperatures. In order to induce aging at room temperature, magnesium was added to the aluminum-copper-lead-bismuth alloy, but this resulted in the impairment of the free cutting properties of the alloy. It was discovered that with the addition of certain alloying elements, the desirable cutting characteristics were regained and exact composition limits were worked out. The alloy in the W temper was found to have properties comparable to those of duralumin and free cutting brass in both strength and toughness. In the T temper, involving aging at slightly elevated temperatures following a solution heat treatment, very high yield, tensile and shear strengths were obtained, although this was done at the expense of some elongation and toughness.

Range of Choice of Alloys

In recapitulating it may be seen that there are now available two alloys, one with magnesium content, one without, in two tempers, so that there is a choice from four different materials to be made. Considerable production experience has been accumulated in the use of all of these materials. In some applications, such as the manufacture of a counter wheel, the free cutting aluminm alloy rod has replaced free cutting brass rod with no change in machine set-up, speeds, feeds, or tool angles, indicating that these new alloys are capable of adapting themselves to extremely high speed production.

Tool Set-Up

In some cases it has not always been possible to maintain exactly the same tool set-up used for free cutting brass, principally because of stock breakage. This trouble can be eliminated by slightly increasing the rake and clearance of the tools to about the same angles used for steel screw machine rod. On the other hand, when duralumin-type alloys are replaced with these free cutting alloys, the acute entrant angles necessary to machine the former may cause the tools to bite in so deeply that breakage of either tool or work may occur. Should this happen, then the clearance and rake angles must be reduced.

The tool wear on free cutting aluminum alloys appears to be slightly higher than on free cutting brass, but is much lower than that obtained with steel or duralumin screw machine stock.

It must be emphasized that no two metals are exactly alike and the maximum economical return can be achieved only by recognizing the peculiarities of each material and by taking advantage of its favorable properties. Thus, although the tool wear with these free cutting aluminum alloys may be somewhat higher than for free cutting brass, the low density of the aluminum alloys frequently makes possible higher speeds or a lower rate of deterioration of machines at existing speeds.

Fields of Application

Although the development of free cutting aluminum alloys represents a great step forward in the history of screw machine products, it is not to be assumed that they will displace all aluminum alloys previously utilized. The long history of the duralumin-type alloys in various structural applications, and their position in approved specifications, will be responsible for their continued use.

Again, since application requirements are almost infintely varied, it is to be expected that in many instances it may be economical, in the long run, to utilize materials of inferior machining characteristics because optimum service qualities may not be available in alloys possessing maximum machineability. The resistance of different alloys to deterioration by corrosion varies greatly with the application environment and, accordingly, in some cases machining characteristics must be subordinated to corrosion resistance.

On the basis of limited accelerated laboratory tests, the corrosion resistance of both free cutting alloys in the W temper appears to be comparable to duralumin-type alloys. The application of precipitation hardening treatments, in order to put the alloys in the T temper, seems to result in a slight decrease in corrosion resistance. Even in this temper, however, the corrosion resistance is comparable to that of other aluminum alloys which are used in large tonnages.

These new alloys offer many opportunities for the economical production of parts for a wide variety of structural assemblies. They are resistant to tarnish and corrosion and in their natural finish possess a pleasing white color, well adapted to modern color schemes. If another color is preferred, it may be applied by means of the Alumilite process.

This is an operation whereby a very thin, but very durable, coating of aluminum oxide is imposed on the surface of the metal. This coating can be colored with either dyes or inorganic pigments and a wide variety of color is available. Patents and applications for patents on this process are owned by Aluminum Colors, Inc., of Pittsburgh. This concern, formerly of Indianapolis, was purchased by Aluminum Company of America.

In common with all aluminum alloys, the new free cutting materials have the low densities particularly desirable in moving parts. It is hoped that these metals will find economic justification for their existence by supplying a material whose properties are unique and which may fulfill the requirements of some applications better than any other substance.

Smelting Dirty Copper

Q.—I have a quantity of scrap copper that I wish to clean before melting it into bronze for making small articles of art. Now I get considerable sulphuric acid discarded from unused fire extinguishers which are recharged once a year. Can that acid be used in any way for a pickle for cleaning that copper? If not, what is a satisfactory solution? Or, after all, if the dirty copper is melted can the dirt be depended upon to float to the top and be skimmed off? I am having trouble getting pure metal into the molds, in spite of using plenty of charcoal and other precautions. I have just purchased a No. 8 bottom pour crucible which I hope will help matters. My alloy is copper 88, tin 6, lead 5, zinc 1.

A.—You would not gain anything by cleaning your scrap copper before smelting. When you melt your copper all the dirt is burned up, nothing left in the copper, except oxides taken up from the air while melting.

What your mixture needs after you have added the tin, lead and zinc is to be deoxidized with 2 to 3 ounces of 15%-phosphor-copper, and when melting add a handful of common salt to the metal and cover with a handful of silica sand. You will find this will improve your alloy.—**W. J. Reardon.**

Making Strong Brass and Making Brass Strong

By MICHAEL G. CORSON
Consulting Metallurgist, New York

Practical Considerations in Producing Brass Castings and Forgings. Conclusion*

Nickel and Manganese

We shall start with nickel, even if for the only reason that the superior properties of German or nickel silver were known long ago. Here we shall see that by adding about ten parts of nickel to 90 parts of a 2:1 brass we obtain a nickel-silver with 10% Ni 30% Zn and 60% Cu, the structure of which remains alpha, while its strength goes up from 46,000 for the plain brass to 58,000 for the nickel brass; the elongation remaining the same, 65%, (as wrought and annealed).

Further additions of nickel to any given alpha brass produce lesser and lesser effects per unit added. It is evident that nickel, even if exerting a certain hardening influence cannot be said to produce a really strong brass. There is no use adding 10% nickel to a 34% Zn brass for the sake of obtaining 58,000 of strength when a 41% Zn brass will show the same. If nickel is added to alpha brass it is for some other reason (mostly ornamental).

In beta brass nickel is soluble only slightly. Larger additions of nickel cause such a brass to revert to a duplex brass without any noticeable gain or loss of strength, although ductility is definitely increased. Here nickel does not serve even an ornamental purpose, for in small quantities it does not whiten the alloy.

Hence the conclusion: nickel itself does not constitute a strong hardening influence when added to brasses in small amounts.

Manganese occupies a somewhat peculiar position. The perusal of tables showing the influence of manganese upon brasses, tables compiled long ago, leaves one quite bewildered. The values given are "all over the map." It might be concluded that the behavior of manganese in brasses is most erratic.

Nothing is more remote from the truth. If manganese brasses are properly made and cast, they show a considerable and continuous increase in strength in comparison to plain brasses with the same ratio of copper to zinc. In fact manganese behaves—at least when added to brasses with more than 15% zinc—as another and more potent variation of zinc. Complex manganese alpha brasses do not reach the possible limit of 65,000, but they approach it closely. Complex beta brasses are also benefited because manganese is quite soluble in the beta constituent. Strengths up to 85,000 are obtainable in such alloys, but their ductility drops seriously.

However, this increase in strength is rather small if figured per unit of manganese added. In alpha alloys it parallels that produced by nickel. In beta and in the duplex brasses it is far lower than corresponds to a unit of tin. Furthermore, ternary brasses high in manganese are sluggish and do not fill the molds well. Hence they too can not be considered as representing specifically strong brasses.

The Action of Aluminum

Far different is the action of aluminum upon brasses. We shall not dwell long upon the reasons why the specific action of aluminum was not definitely recognized long ago. There is no doubt for instance that all the strong brasses (Delta metal, Parsons bronze, Turbadium bronze, Immadium bronze and what not) owed their strength to the action of aluminum, but for reasons of a peculiar nature its presence in those alloys was hushed up.

Aluminum dissolves well in non-saturated alpha brasses and increases their strength thoroughly and continuously without affecting their ductility. It is the only element that permits us to obtain a strictly alpha brass with 65,000 strength—exactly corresponding to a saturated aluminum alpha bronze.

Aluminum dissolves also in the beta brass and here its action per unit added is quite considerable.

But the main influence of aluminum is found in its action upon alpha brasses when it is added far in excess over the amount needed for their saturation. It starts then to convert such brasses from an alpha to a duplex and from a duplex to a pure beta structure. And the strength of the complex brass so obtained is continuously increased.

At the same time the ductility is reduced and the elastic limit raised. Finally one may obtain a brass containing say 30% zinc and 5% aluminum, which possesses 105,000 strength and an elongation of 5% (in the bottom part of the horizontally sand cast test bar).

These mechanical characteristics coupled with the specific beta structure are not duplicated in any other ternary copper alloys except when obtained by heat treatment or cold work.

Theoretical considerations show that one binary

*Parts 1, 2 and 3 were published in our March, April and May issues.

alloy might show analogous properties, namely a 12.5% aluminum bronze, if it were stable at ordinary temperatures. Unfortunately it suffers a breakdown at 570 C. and below this temperature is quite fragile.

The fact, however, that from a plain saturated beta brass with 77,000 strength and 37% elongation we can arrive by a gradual and proper variation of the ratio of aluminum to zinc to a ternary beta brass with 105,000 and 5% elongation is quite interesting.

It appears as if we were moving away from a stable beta brass with a mediocre strength through less and less stable but stronger beta brasses toward the totally unstable, but hypothetically extremely strong beta aluminum bronze.

And here is the solution of the riddle. Strong brass represents an intermediate composition between a pure beta brass and a pure beta aluminum bronze. It is a ternary copper-zinc-aluminum alloy.

However, this is only a partial answer, for who wants an alloy of high strength but a treacherously low ductility? Is not there a way to increase the stability and the ductility of an aluminum brass without decreasing its strength?

Stabilizers for Aluminum Bronze

This answer, happily enough, exists. There are two elements, which can increase the stability of a strong aluminum brass and the same elements increase the stability of the beta aluminum bronze. They are iron and manganese.

Of these two iron is more potent for the first small amounts added. One per cent, perhaps 0.5% suffices, but beyond this amount iron does not exert any useful influence.

Manganese acts more slowly. It takes about 3% manganese to obtain a good stability, and a high ductility in certain aluminum brasses. In others, higher in aluminum and lower in zinc, as much as 6% is necessary.

But manganese has a double effect. It stabilizes the alloy and it adds somewhat to its strength. And rather high amounts of manganese can be added usefully, while the usefulness of iron stops at the low figure of 1%, probably less. It must only be stated, that much higher amounts of iron can be present safely in a beta aluminum brass—a high tensile brass; this in spite of its great tendency to segregate.

Can nickel act the part of a stabilizer? By no means. It is not at all soluble in an aluminum beta brass and separates in the form of large oval grainlets looking violet under the microscope. These grainlets do not represent pure nickel, but rather a sort of a compound of nickel with aluminum. In this manner the beta brass becomes impoverished in aluminum and is weakened. The more nickel one adds the less strong the brass becomes and instead of remaining a beta brass it becomes a duplex brass because the alpha constituent is regenerated.

With much higher contents of nickel the process becomes reversed—but this feature is beyond the scope of this article, at least from the viewpoint of mechanical character.

What properties can be obtained in a high strength brass? The present-day limit is about 115,000 with 20% elongation either in the forged or cast state. In the last case it pertains only to the soundest bottom part of a horizontally cast ingot, where neither microshrinkage nor gas development influence the characteristics. These values must be considered as a goal for which to aim if a really high tensile brass is desired. They can be obtained, for instance, in an alloy with 35% zinc, 3% manganese and 4.2% aluminum. Instead of manganese a 65% ferro-manganese can be used with the same results as far as the stabilizing effect goes.

Other alloys too can possess 115,000 strength. If for instance, a brass contains 15% zinc, it will take 6.2% aluminum and 6% manganese to obtain this value. But its ductility will drop to 10%. On the other hand the hardness will go up from 185 to 250 Brinell and the yield point from 70,000 to 100,000. In the same alloy the content of manganese can be advantageously increased to 12%, when the alloy will possess a yellowish white color and be capable of taking a fine polish and an extremely smooth, velvety surface.

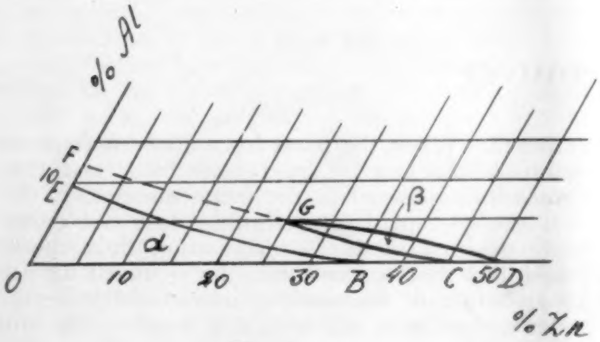


Fig. 1

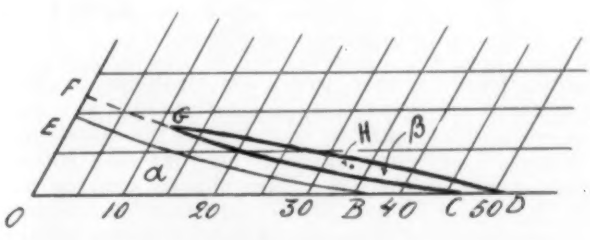


Fig. 2

FIG. 1. Approximate location of different fields in high stength brasses containing only copper, zinc and aluminum.

FIG. 2 Same fields when about 2% of zinc or over are substituted by 2% manganese or over; or still better, when, instead of pure manganese, a 70/30 ferromanganese is used to the extent of the same 2%. Above 2% all substitution must be done with pure manganese for zinc.

The point G is, in both cases, the limiting composition. To its left along the lines FG the alloy becomes brittle. To its right, within the region CGD, lie the high strength brasses.

At the point G (on the right) a strength of 115,000 lbs. with the same elastic limit, a hardness of 270 Brinell and almost no elongation is obtainable. In the region CGD (enlarged by the use of manganese) the maximum strength remains practically unaffected down to the point H. At this latter point hardness drops to 180, the elastic limit to 60,000 lbs., but the elongation increases to 23%.

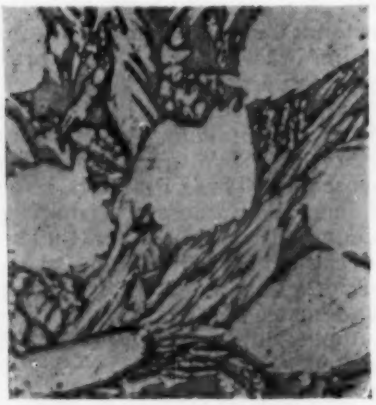


FIG. 2. The structure of a sand cast high tensile brass with about 25% alpha and a t.s. of 90,000 lbs.

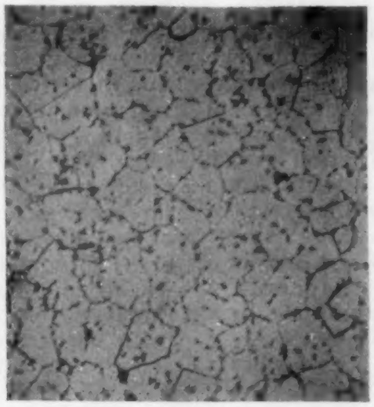


FIG. 3. Chill cast, high strength beta brass with 106,000 lbs. strength; 18% elongation

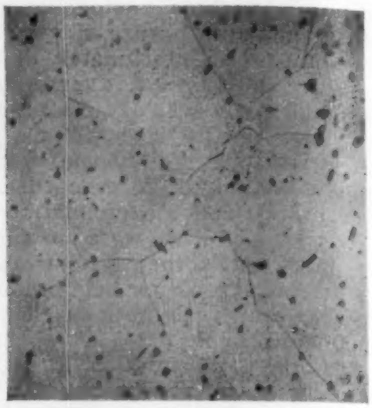


FIG. 4. Same high strength brass, sand cast, 103,000 lbs. strength and 14% elongation

Conclusions

Are such high tensile brasses of the complex beta type of much industrial value? The present author believes, that their importance may be very great indeed, especially for various parts of machinery working under friction. However, there was a time when high tensile brasses were tried out and found wanting, especially when subject to the action of saline water or if improperly forged. There was raised the cry "They dezinkify," and "They are season cracking." Perhaps there was enough truth in these statements, but the situation was never thoroughly investigated.

Nevertheless, the really high tensile brasses are not much in use now. Theirs is the future. To-day a moderate high tensile brass with not over 90,000 and not less than 80,000 strength and with 35% ductility forms the bulk of the demand. This can be easily obtained by cutting off 2% of aluminum in the mixtures previously described and substituting copper for it. A brass of this kind will contain about 25% of the alpha constituent. Whether a mixture of 25% alpha and 75% beta is really more stable chemically than a pure beta is a question open for future and better investigations.

How to make high strength brass? We might say —by adhering to the same instructions of melting the metal quickly enough and avoiding long contact with the furnace gases. This applies well to the making of small heats of high tensile brass in crucible furnaces. However, such brasses are most frequently cast in pieces weighing many tons and the only tools available for this kind of work are large reverberatory furnaces where the furnace gases come in a direct contact with the melt. As ar as melting is concerned we can indicate the use of carefully ingoted and checked metal, and avoiding overheating. A proper treatment of the molten metal out of the furnace is of such a greater consequence. This we shall discuss on another occasion.

Rust Remover

Q.—We have a rust removing problem in the preparation of ice cream cans for retinning. We are able to remove the surface rust but in the construction of these steel cans, there is an iron ring rolled into the bottom of the can. This ring is causing us considerable trouble, due to the fact that we cannot seem to remove all of the oxide at this particular point.

We have tried many different acid solutions as well as guaranteed rust removers that are on the market but so far have been able to make no headway in this matter. Due to the fact that these cans have to be cleaned and tinned at a small cost we are in need of a quick action rust remover. We are told that concerns making a specialty of this work can free a can of rust in about three minutes.

A.—The usual method of retinning ice cream cans is to take the can apart, and see that each part is properly cleaned and pickled. The individual parts are then repaired; dents are removed from the body section before retinning, and the bands, hoops, etc., are pickled and all the rust removed before they are retinned. When the parts have all been repaired and retinned, the can is again assembled, and then retinned and soldered in the usual manner.

If the cost paid for retinning does not cover this more detailed method of retinning, then there is a possibility that the rust may be removed by using a 2% solution of commercial muriatic acid, cold. In order not to harm the article it is advisable to use a very small amount of inhibitor.

In trying this method you can start with a 2% acid and if that is too weak make it stronger until you get results. A slight heating of the acid will also make it cut a little harder. Of course as you know, the only right way to do this is to take the can apart as stated above, but many times in practice this is not possible from a cost standpoint.

You will, we believe, get the results you want by pickling with muriatic acid with an inhibitor in the acid to stop its action after the rust is removed. Then wash thoroughly, flux, and retin in the usual manner.

—W. Imhoff.

Standard Quality for Plated Tableware

By F. C. MESLE
Oneida, Ltd., Oneida, N. Y.

Quality Marks Should Indicate the Base Metal, the Average All-Over Plate and the Thickness of the Plate at Special Wear Points. Practical Measurement of Thickness

Facts vs. Sales Talk

FROM many different sources come indications that there is a growing demand that advertising and sales appeals be debunked, and that consumers be given a chance to know something about the real value of the goods they want to buy, or are induced to buy, under pressure of super-sales talks and advertising of the same character. This trend toward truth in advertising meets strong resistance from many manufacturers, sales and advertising agencies, and newspapers and magazines who derive their chief support from this type of advertising.

People of average intelligence must know that there is no direct connection between retaining that "school girl complexion," and the use of a certain ordinary soap, or that printing "not a cough in a carload" on a package does not change the nature or the effect of that particular brand of cigarette.

It is well known that whenever anyone achieves outstanding leadership or championship in any field, advertising agencies are willing to pay handsome sums for the privilege of using their names in connection with a product to be advertised. That the individual never had known about the product does not matter.

All this may have no bearing on standard quality for silver plated tableware, but it does indicate that in this, as in all other advertised things, standard quality marking should be developed and used that will fairly represent the value of the goods offered for sale. At present there is no such standard for silver plated table flatware in general use. Specifications developed by the Bureau of Standards for use by the Federal Government when purchasing silverware are the only adequate standards that have been set up that come any where near specifying quality. Their specifications, of course, are not in general use, but should be a guide for the development of standards that will be a real measure of quality.

Present quality standards for plated tableware are measured by the reputation developed over a long period of time for quality goods by a manufacturer. The name "Tiffany," "Rogers Brothers 1847," "Gorham," "Community Plate," "Reed and Barton" and a host of "Rogers" all mean something to some people, but they do not mean the same thing to all the people. The impression that advertising their different brands of silverware, made on the people who read them, is largely responsible for the difference of opinion about the quality of these various brands of silverware. Who can say what brand is the best buy? Isn't it unfair to leave people at the mercy of advertising talent in judging the value of the silverware they buy?

Of course some of the factors of quality are apparent to the prospective purchaser, such as weight of the piece, style, beauty of design, kind of finish, but these are not vital factors that determine quality. Let us assume that all the apparent factors are satisfactory to a buyer on two or more brands. Quality and price would be the next consideration. Again the question may be asked, who can give the correct answer as to what brand is the best buy? Today the answer is found in sales talk and advertising skill which are apart from the real quality of the goods.

Weight of the goods, style, beauty of design and kind of finish, as factors of quality are determined largely by the taste and judgment of the individual consumer, and could be used as advertising features and sales appeals, and are the only factors that should be so used. The more important factors of quality such as base metal, total weight of the silver plate and thickness of the silver at the point of greatest wear, may be called hidden factors of quality. Standard markings should be developed that will reveal what these hidden quality factors are so that no matter what brand of silverware is being considered, the standard marking would reveal the hidden quality.

True Quality is Measured by Length of Life

The yardstick of quality in general use is the total weight of the silver deposit per gross of spoons or forks, but this has little to do with the real quality. A true quality measure is the length of service given under average conditions before the silver plate is worn off and the base metal exposed to a degree that it is objectionable to the user.

The most important hidden factor of quality is the amount of silver plated on the goods and the thickness of the silver at the points of greatest wear. It is in this connection that a quality yardstick is needed most.

The back of handle is a wear point, but objectionable wear can be avoided by the bend of the handle or the design on the handle so that the wear point will be on the edge of end of handle or on the fine

lines of the pattern, in which case no objectionable wear will be in evidence as the silver wears off on the sharp edges.

No matter how thick the silver may be, in a comparatively short time it will wear through to the base on sharp edges, such as the cutting edge of a knife blade and the edge of the bowl of spoons or fork tine points. It is not practical to adequately protect these points by plating with silver but these points are not vital because difficult to see, hence not objectionable. For these reasons sharp edges can be ignored in considering the service life of plated flatware.

Because the bowls of spoons come in contact with food and the mouth the base metal exposed to a degree easily apparent, becomes objectionable to the user.

The weight of the silver deposit, per piece or per gross, is the yardstick of quality in general use. There is a tendency to specify quality in terms of average weight per square foot of surface plated. The latter is an improvement over the former.

British Standards for Silverware

Standards developed by A. J. Round of B. J. Round & Sons, Birmingham, and published in the monthly bulletin of the "Birmingham Jewelers and Silversmiths" Association, September, 1932, are called "Epalex Standard." Their standard set up for nickel silver plated with silver is expressed in troy ounces per square foot of surface plated.

This standard is as follows:

Standard	Mark	Ozs. Silver Per Sq. Ft.	Approx. Period of Wear in Years	This Would Produce a Thickness of Approximately
"Epalex" A1	E.P.N.S.	1.5	20	.00190
"Epalex" A	E.P.N.S.	1.	10	.00125
"Epalex" B	E.P.N.S.	.75	5	.00096
"Epalex" C		No guaranteed Weight	3	?

To plate the above thickness would require much more silver than is generally put on by British manufacturers for the quality marks A1, A or B. Silver required on average British teaspoons to give "Epalex" thickness follows:

"Epalex" A1	8.55 oz. per gross	14 Dwt. per Doz.
"Epalex" A	5.70 oz. per gross	9.5 Dwt. per Doz.
"Epalex" B	4.27 oz. per gross	7.1 Dwt. per Doz.

The code for tableware flatware is as follows:

"Quality standards for the silverware manufacturing industry approved by the NRA administration applying to plated flatware and hotel flatware are shown in the accompany table:

1. The quality marks "Sectional," "Overlay," "Overlaid," "Spot Plate," "Reinforced" indicate that each and every piece bearing all or any of these marks has an extra deposit of pure silver at the "heel" or base of bowl or tines on spoons and forks. These marks cannot be stamped on any pieces whose overall plating deposits are not equal to "A1" or "Standard" equality as defined in this memorandum, and the extra deposit must be **in addition** to the overall "A1" or "Standard" plating deposits. On higher qualities of silver plate the extra deposits can be **included** in the total overall deposit standards as set forth in this memorandum.

2. The quality mark "XII" indicates that each and every piece bearing this mark has an extra deposit of pure silver at more than one wearing point. For example, heel of bowl and back of handle at end. This mark cannot be used on pieces whose overall plating deposits are not equal to "A1" or "Standard" as defined in this memorandum, and the extra deposit must be **in addition** to the overall "A1" or "Standard" plating deposits.

General Rule No. 1—No quality stamps such as "10 Year Plate," "25 Year Plate," "Life Time Plate," etc., can be used since such stamp would be in violation of the "Time Guarantee" prohibition in the Code.

General Rule No. 2—It is the avowed intent and expressed desire of all manufacturers of silver plated flatware that quality standards protecting consumers, merchants and manufacturers, shall be established and maintained. In this spirit it is declared—

(a) All marks which may be later developed and used, and which are in the opinion of the Code Authority, imitations or simulations of the marks as established in this memorandum, must be declared a violation of Section 17, Article VIII unless goods so marked conform to the quality standards of the mark so imitated or simulated.

(b) It would also be a violation of Section 17, Article VIII to develop and use such marks as "Best Plate," "Excellent Plate," "Highest Quality Plate" or other marks of this character, which in the opinion of the Code Authority are untrue or exaggerations.

Quality Standards Applying to Plated Flatware and Hotel Flatware

	Teaspoon Oz. Silver Per Gross	Dessert Spoon Dessert Fork R. B. Soup Spoon Oz. Silver Per Gross	Table Spoon Dinner Fork Oz. Silver Per Gross	Base Metal
"A1" or "Standard"	2	3	4	18% Nickel Silver
"A1+" or "A1X" or	2 Plus Overlay	3 Plus Overlay	4 Plus Overlay	18% Nickel Silver
"Extra" or	2½ No Overlay	3¾ No Overlay	5 No Overlay	18% Nickel Silver
"AA"	3	4½	6	18% Nickel Silver
"Double" or "XX"	4	6	8	18% Nickel Silver
"Triple" or "XXX"	6	9	12	18% Nickel Silver
"Quadruple" or "XXXX"	8	12	16	18% Nickel Silver

American Standards for Silverware

Standards set up in the United States by N. I. R. A. code authority specify average weight per gross for flatware and weight per square foot of surface plated for Holloware are as shown in the table above.

Federal Specifications for Silverware

The United States Federal Specifications set up by the Bureau of Standards, specifies weight per gross, average thickness and a minimum thickness at the wear point or bearing surface back of bowl on spoons and back of tines on forks as follows:

	Weight of Silver: Troy Ounces Per Gross, Present	Troy Ounces Per Gross, Proposed Change	Troy Ounces Per Sq. Ft., Present	Troy Ounces Per Sq. Ft., Proposed Change	Minimum Thickness of Silver: Average, Present	Average, Proposed Change	Back of Bowl, Present	Back of Bowl, Proposed Change
Teas	6	9	0.64	1.0	.0008	.00125	.0012	.0018
Tables	12	20	0.64	1.0	.0008	.00125	.0012	.0018
Dess. Spoons	9	15	0.64	1.0	.0008	.00125	.0012	.0018
Soup Spoons	9	15	0.64	1.0	.0008	.00125	.0012	.0018
Dess. Forks	8	15	0.64	1.0	.0008	.00125	.0012	.0018
Dinner Forks	10	20	0.64	1.0	.0008	.00125	.0012	.0018

The present Federal Standards evidently do not give the service life desired hence the proposed change. I am sure that the improvement in service life produced by the proposed change would be realized if the extra thickness was only put on the wear point back of bowl.

The Real Measure of Quality of Silver Plate on Tableware

1—The thickness of the silver at the point of greatest wear back of bowl on spoons and back of tines on forks.

2—Average all over thickness of the silver.

The high point in quality is reached when the total silver is distributed so that the points of most wear will not wear through to the base to an objectionable degree during the life of the all over plate. An ideal construction for a pair of shoes is to build the sole to give the same length of service without repairs as the upper part of the shoe.

To illustrate this point—a "two ounce" plate on teaspoons evenly distributed over the surface may give satisfactory service from 10 to 12 years but at the wear points less than 2 years; or, on a two-ounce all over plate the back of bowl thickness should be at least five times the average all over plate.

A well known line of "silver inlay" has a back of bowl thickness nearly one hundred times as thick as the average all over plate, or a 5 oz. per gross all over plate, and a 100 oz. thickness back of the bowl and back of handle. Obviously this is not an economical practice but it is sure to give service life at wear point during the life of the all over plate, but forces the cost up for the average service life of the piece, and in this case the service life is measured by the all over plate which is approximately 30 years.

Proper Quality Marks

Quality marking should indicate all three factors of quality:

1—Base metal
2—Average all over plate
3—Back of bowl plate or thickness

The following is suggested as one way to do this:

E.P.N.S.-18 the figure indicating % of nickel in the nickel silver base.

A1, A and B could be used to indicate average all over plate as they do at present. To the present marking could be added a number to indicate the back of bowl thickness in relation to the all over plate A1 + 2 could indicate A1 over all and twice this thickness at back of bowl wear point, and A1 + 3 would indicate three times average all over thickness at back of bowl wear point.

The mark "E.P.N.S.-18-A1 + 3" would mean 18% nickel silver base, 8 Dwt. per doz. silver deposit distributed to give three times the all over plate thickness on the wear point back of bowl. This would be the highest quality that can be produced with a total silver deposit of 8 Dwt. per doz. A back of bowl thickness three times the average all over plate thickness of A1 quality increases the service life about five times instead of three as might be assumed from the viewpoint of thickness alone. This is because the area of the contact surface at wear point back of bowl increases as the silver is worn off, so that the curved contact point back of bowl develops into a flat contact point that grows larger as the plate is worn off; or if we could start with a 3/16 flat contact surface on a teaspoon the same thickness of silver would give from three to four times the service life than when we start with the curved contact point that is normal on a teaspoon.

Because the service life of the silver plate increases in proportion as the flat spot develops at the wear point back of bowl and since no such flat spot develops elsewhere on the spoon, the relation between the all over plate thickness and the wear point thickness to give balanced service life will change with the all over plate standard.

On a 1 oz. per gross all over plate the back of bowl thickness should be seven times the all over plate thickness for balanced service life. The relation between all over plate thickness and wear point thickness should be approximately as follows:

Silver Deposit

All Over Plate Oz. Per Gross	Dwt. Per Doz.	To Give Balanced Service Life Wear Point Thickness	to	All Over Thickness	Quality Mark as Suggested on 18% Base
1	1.67	7	—	1	1—6
2	3.34	5½	—	1	1—4½
4	6.68	4	—	1	1—3
6	10.00	3½	—	1	1—2½
8	13.33	3	—	1	1—2
10	16.67	2½	—	1	1—1½
12	20.00	2	—	1	1—1

The standards set up by the NRA Code Authority do not correctly express quality. To illustrate this point, take the standard marking for A1+, A1X, A1 Extra. For these markings on teaspoons a 2 oz. per gross all over plate is required plus an overlay plate of no stated amount, or a 2½ oz. all over plate. Let us note some of the variations in quality that can be produced and still meet these specifications.

An all over plate of 2½ oz. on teaspoons evenly distributed over the surface of the spoon will give a silver deposit of approximately .0004" thick, this thickness would wear off at the wear point back of bowl in about 3 years in family use yet show no objectional wear elsewhere during four to five times this number of years. This same total deposit of silver if distributed so that 2 oz. plate is put on all over and ½ oz. as over-

lay at wear point back of bowl (size of spot ¾"). This would reduce the all over plate 20% and increase the wear point thickness more than 4 times or a thickness that would give at least 12 years service life back of the bowl. This will balance with the all over plate for service.

The above shows variation of 400% in real quality possible within the specification required to mark goods A1, A1X or A1 Extra, and this same variation is possible in the other grades set up by the Code. Surely these standard markings do not indicate quality. I would suggest quality marking that comes more nearly indicating real quality.

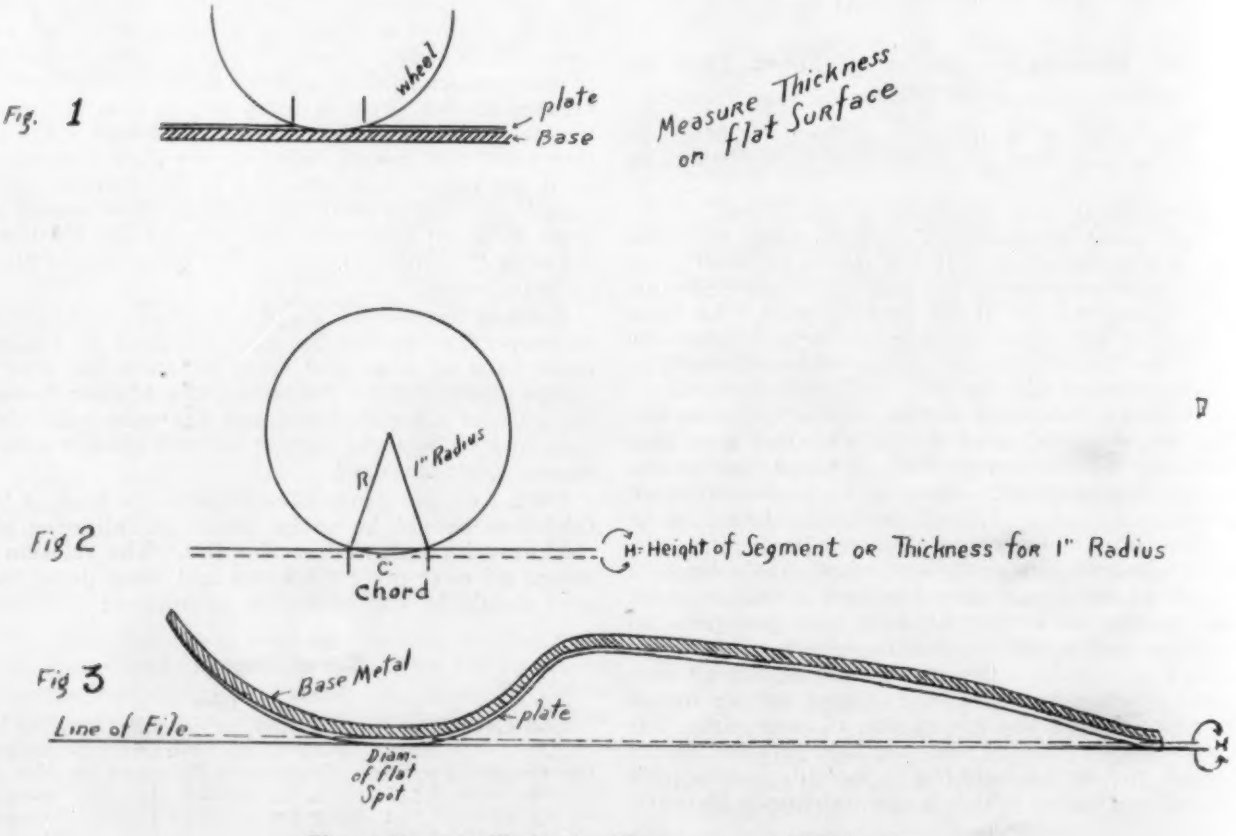
A1 should mean 2 oz. silver per gross on teaspoons. This same marking method could be used for Double plate, Triple plate, etc.

Specifications that govern markings as suggested above surely indicate quality more accurately than present specifications and markings.

Measuring the Thickness of the Plate

If quality standards are to be stated in terms of thickness of the silver at bearing surface or wear point back of bowl or tines, then a convenient method of measuring thickness of silver should be developed. To measure the silver plate by stripping the silver from the spoon and determine the amount removed by weight, for either the total spoon or from definite locations, require laboratory equipment. I would like to suggest a simple method, one that a salesman or buyer could use at his desk with the aid of a fine file, a gauge and a set of figures for convenience.

The method is this: Draw the spoon or fork over a flat file so that the silver will be removed at the bear-



Figs. 1, 2 and 3. Illustrating Measurement of Filed Surfaces

Other A1 markings should indicate how much the quality is improved by overlay plate—or extra all over plate, for instance A1 + 1 could be used to indicate 2 oz. all over plate and an additional 2 oz. thickness at wear point back of bowl.

A1+4 is the highest quality that can be produced by a total silver deposit of 2½ oz. per gross on teaspoons.

Suggested Marking

	Allover Plate		¾" Spot Overlay Plate		Back of Bowl Wear Point	Year
Marking	Oz. Per Gro.	Approximate Thickness	Oz. Per Gro.	Approx. Thickness	Tot. Thickness	Ser. Life
A1	2	.00034	..	....	.00034	3
A1+	2½	.00042	..	....	.00042	3½
A1+1	2	.00034	.12	.00034	.00068	6
A1+2	2	.00034	.24	.00068	.00102	9
A1+3	2	.00034	.36	.00102	.00138	12
A1+4	2	.00034	.48	.00136	.00170	15

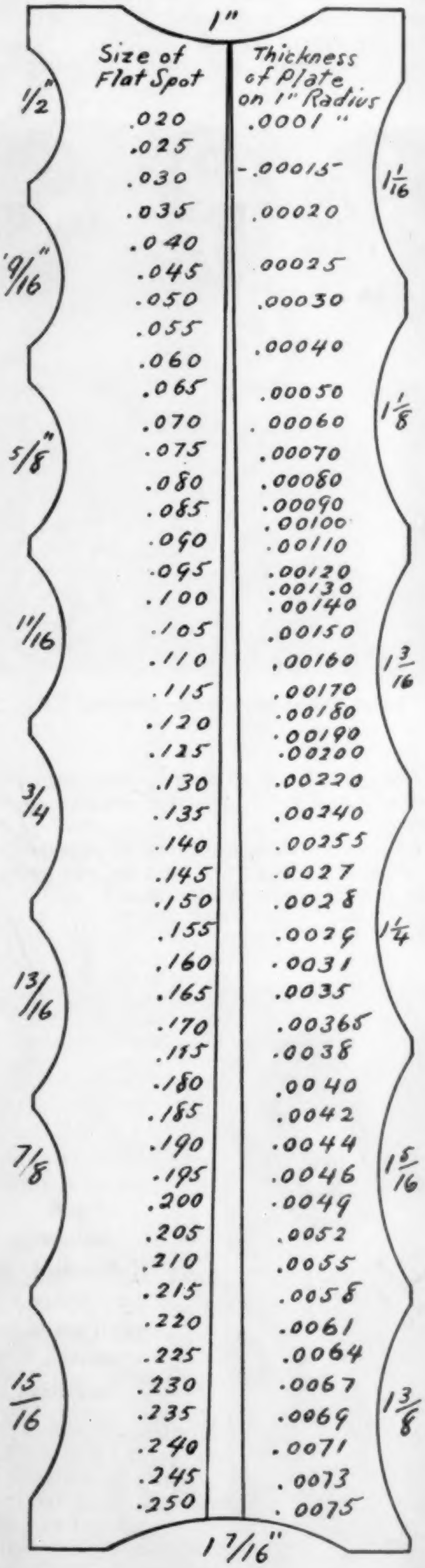


Fig. 4. Gauge for Measuring the Radius and Diameter of the Flat Spot

ing surface back of bowl, being careful that there is no rolling or rocking of the spoon during the filing operation. Care should also be taken to make sure that not more than about 1/64" of the base metal is exposed. When the silver has been thus removed, the diameter of the flat spot will indicate fairly accurately the thickness of the silver removed.

With a gauge to determine the radius of the curve at the point to be tested, and another gauge to measure the diameter of the spot made by the file in cutting through to the base, a fine flat file and a table that will show the thickness of the silver for the radius measured, is all that it needed to get a fair measure of the thickness of the plate, and with a little practice can be determined by anyone. If it is desired to get the value in terms of ounces per gross for teaspoons of average size, or ounces per square foot of surface, such a table could be added to the list.

The thickness of a flat surface could be determined by reversing the method and using a fine abrasive wheel or sphere of a known radius, and measuring the

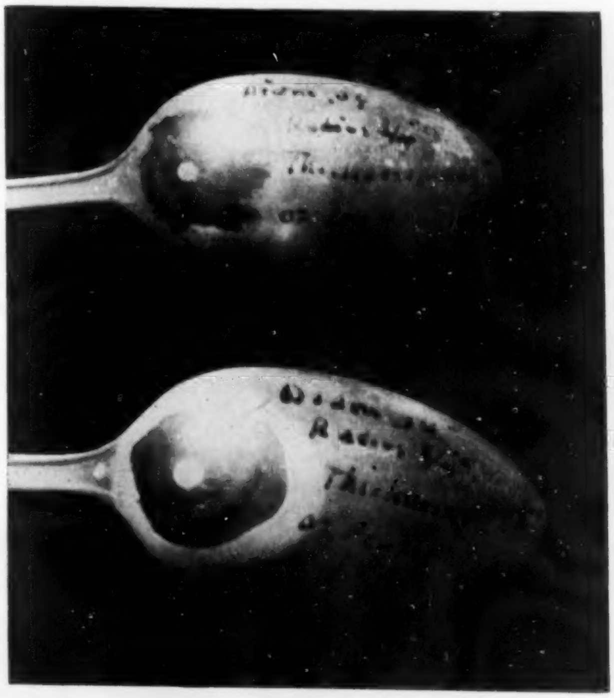


Fig. 5. White Spot Against a Black Oxidized Background

diameter of the spot that comes in contact with the wheel in getting to the base. The article would need to be held in a jig to make sure the abrasive wheel cuts only in one place.

Figs. 1, 2 and 3 illustrate why this is so.

Fig. 4 illustrates the gauge that could be used for measuring the radius and the diameter of flat spot.

It is a little difficult to measure thickness of plate when the plate is less than one ounce per gross on teaspoons, or about .00017" thick.

To make the flat spot show up more prominently for measuring oxidize the surface before filing; then the spot will be white on a black background. (See Figs. 5, 6 and 7).

To check the degree of accuracy that may be at-

tained by the method of measuring plate thickness suggested above, samples were plated so that the plate could be peeled or stripped from the base, and it was measured as suggested. Then the plate was stripped from the base and measured with a micrometer, as nearly as possible to the point where the gauge measure was taken. The results were as follows:

COMPARISON OF THICKNESS MEASURED BY MICROMETER AND METHOD SUGGESTED

Article	Radius of Curve	Measured as Suggested	Measured with Micrometer
Tea spoon	⅝"	.00224	.00230
" "	⅜"	.00208	.00210
" "	⅝"	.00208	.00200
" "	⅝"	.00112	.00130
" "	¾"	.00250	.00300
" "	⅝"	.00320	.00310
Table spoon	1 1/16"	.00066	.00070
" "	1 1/16"	.00066	.00070
Soup spoon	1⅛"	.00048	.00050
" "	1⅛"	.00052	.00050
" "	1 1/16"	.00170	.00160
Dessert spoon	⅞"	.00125	.00120

Fig. 6, shows pictures taken of spoons measured for thickness of plate at various locations back of the bowl. These samples were not hand picked, but are regular "mill runs" as made by different manufacturers and sold to the trade.

It is of special interest to note the distribution of the silver over the surface tested, as it indicates very clearly why the total weight of silver per gross of spoons is not a good measure of quality. Fig. 6, tea spoons No. 2-4-6 average about 20% more total silver than No. 1-3-5. Yet the thickness at the wear point on 1-3-5 is more than three times as thick as No. 2-4-6, or the service life of No. 1-3-5 is more than four times that of No. 2-4-6 at the wear point. The picture also indicates how simple it is to check and recheck these measurements. As long as the article on which the measurement was made is available, it can be rechecked by anyone interested, or the article can be kept as a permanent record.

There is no doubt but that the equipment and method suggested for thickness measurements need further study and refinement for greater convenience and accuracy.

The following table indicates approximate thickness of silver in inches thick, and oz. per gross on tea spoons at the test point back of bowl.

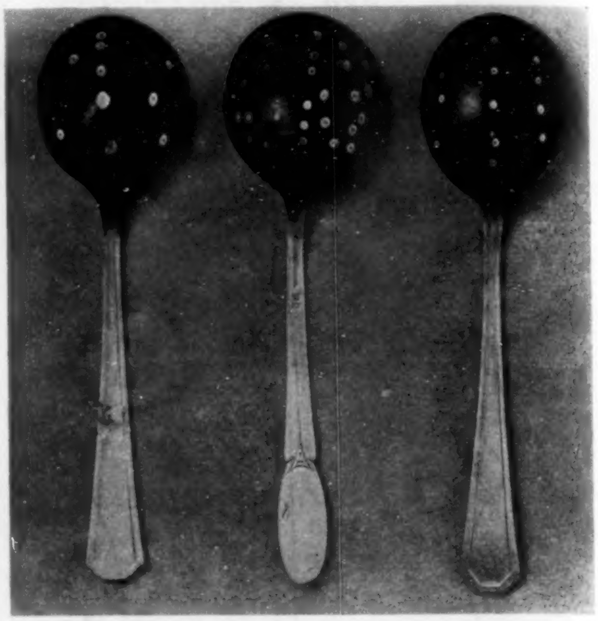


Fig. 7. Local Thickness Measurements on Large Spoons

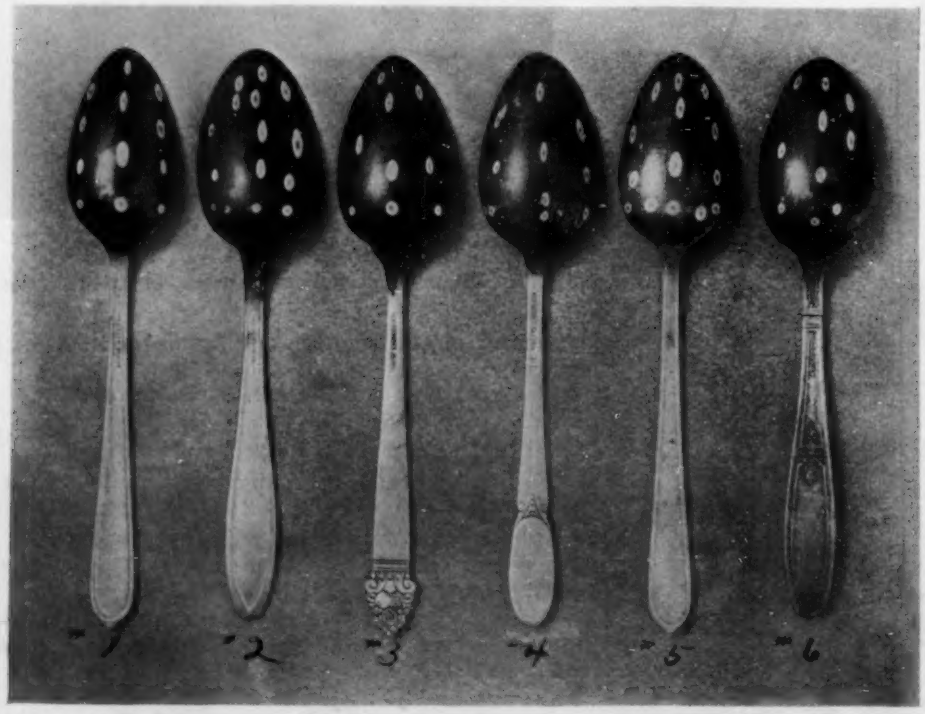


Fig. 6. Spoons Measured for Thickness of Plate at Various Locations

Radius of Curve Back of Bowl Test Point

Diam. of Flat Spot	⅝ Ounces Silver Per Gross	⅝ Thickness of the Silver	11/16 Ounces Silver Per Gross	11/16 Thickness of the Silver	¾ Ounces Silver Per Gross	¾ Thickness of the Silver	13/16 Ounces Silver Per Gross	13/16 Thickness of the Silver
.010								
.015								
.020	.96	.000165"	.88	.000151"	.80	.000137"	.73	.000125"
.025	1.20	.000230	1.10	.000190	1.00	.0001715	.92	.000157
.030	1.44	.000248	1.32	.000226	1.19	.000190	1.09	.000187
.035	1.85	.000320	1.70	.000290	1.54	.000264	1.41	.000242
.040	2.08	.000357	1.91	.000338	1.73	.000297	1.58	.000272
.045	2.32	.000400	2.13	.000365	1.93	.000329	1.77	.000302
.050	2.80	.000480	2.57	.000440	2.33	.000397	2.13	.000366
.055	3.73	.000640	3.42	.000586	3.10	.000532	2.84	.000487
.060	4.64	.000800	4.26	.000720	3.85	.000660	3.53	.000606
.065	5.12	.000875	4.70	.000805	4.25	.000730	3.90	.000670
.070	5.60	.000960	5.15	.000875	4.65	.000800	4.27	..000733
.075	6.56	.001120	6.02	.001035	5.45	.000935	5.00	.000860
.080	7.52	.001290	6.90	.001180	6.25	.001070	5.73	.000983
.085	8.40	.001440	7.71	.001320	6.98	.001200	6.40	.001100
.090	9.28	.001590	8.52	.001460	7.71	.001320	7.07	.001230
.095	10.56	.001820	9.70	.001650	8.78	.001500	8.05	.001380
.100	12.60	.002060	11.02	.001900	9.97	.001710	9.15	.001560
.105	13.04	.002240	11.98	.002030	10.84	.001860	9.94	.001700
.110	14.40	.002480	13.23	.002280	11.96	.002050	11.00	.001890
.115	15.60	.002680	14.33	.002460	12.96	.002220	11.89	.002040
.120	16.80	.002900	15.43	.002650	13.96	.002390	12.81	.002200
.125	18.80	.003240	16.54	.002840	14.96	.002530	13.72	.002360
.130	19.20	.003300	17.64	.003100	15.96	.002740	14.64	.002500
.135	20.80	.003580	19.11	.003280	17.29	.002960	15.86	.002720
.140	22.40	.003860	20.58	.003450	18.62	.003200	17.08	.002940
.145	24.00	.004120	22.00	.003780	19.95	.003420	18.30	.003140
.150	26.08	.004600	23.96	.004100	21.68	.003720	19.88	.003410
.155	27.92	.004800	25.63	.004400	23.21	.003980	21.28	.003500
.160	29.76	.005100	27.34	.004700	24.74	.004250	22.70	.003900
.165	31.68	.005450	29.10	.005030	26.33	.004520	24.15	.004140
.170	33.60	.005780	30.87	.005300	27.93	.004780	25.62	.004420
.175	35.36	.006100	32.48	.005580	29.39	.005050	26.96	.004620
.180	37.12	.006400	34.10	.005860	30.85	.005360	28.30	.004850
.185	38.56	.006600	35.42	.006100	32.05	.005500	29.40	.005050
.190	41.60	.007000	38.22	.006568	34.58	.005920	31.72	.005450
.195	44.00	.007560	40.80	.007020	36.57	.006260	33.55	.005750
.200	46.00	.007900	42.63	.007330	38.57	.006620	35.38	.006060
.205	48.00	.008250	44.10	.007560	39.90	.006850	36.60	.006300
.210	51.20	.008800	47.04	.008080	42.56	.007360	39.04	.006700
.215	54.08	.00930	49.68	.008530	44.95	.007700	41.25	.007100
.220	56.48	.00967	51.89	.008900	46.94	.008050	43.06	.007400
.225	60.48	.01030	55.56	.009550	50.27	.008600	46.11	.007750
.230	62.40	.0107	57.33	.009900	51.87	.008900	47.58	.008200
.235	64.00	.0109	58.80	.010100	53.20	.009150	48.80	.008380
.240	66.24	.0113	60.85	.010400	55.06	.009450	50.50	.008670
.245	68.00	.0116	62.47	.010850	56.52	.009650	51.85	.008900
.250	69.76	.0120	64.09	.011000	57.98	.009920	53.19	.009140

(To be more complete, this table, to include coffee spoons to table spoons, should have a range from ½" radius to 1½" radius, or 17 columns of figures like these).

Bushings for High Temperature Cylinders

Q.—Can you suggest the kind of metal to use for bushings in the cylinders of type setting machines, and where I can secure it? These parts are submerged in the pot of type metal at a temperature of about 800° F.

A.—It is likely that Monel metal will serve your purpose. This is an alloy containing about 68% of nickel and 28% of copper. This metal resists oxidation up to about 1000° F. It may be secured in rods, sheets, tubing and castings. It may be machined without difficulty. Other metals that may be worth trying are the alloys of cast iron containing nickel and chromium, and known as the Ni-Resist group. These metals contain copper as well as the usual carbon and silicon of cast irons.—**W. B. Francis.**

Antique Iron on Brass

Q.—Am sending you a ring that we must get a similar finish for. I have tried many formulas but failed to strike it. Now we would appreciate it if you could help us out in this matter.

A.—This is a pigment finish. The brass casting has been nickel plated then transferred to a black nickel solution to get the under coat color. On this base proceed as follows: take burnt sienna in oil, raw sienna in oil, raw umber in oil and flake white in oil. Using the flake white as a base add very small amounts of the other colors to get the desired shade. Brush over the parts with the paste and allow the parts to dry partially and dust with rotten stone or other brown powder to destroy the luster.

W. Fraine.

Oxidizing Agents for Nickel Solutions*

By W. A. WESLEY

Research Laboratory, International
Nickel Company, Bayonne, N. J.

THE need for exposition of the mechanism of the action of oxidizing agents in nickel deposition has been long felt and has now received a very satisfying answer in the paper under discussion. This is the first thorough study of the subject and in view of this fact and of the importance of the subject to the plating industry it seems an opportune time to point out that, contrary to popular belief, the beneficial effects of oxidizing agents in nickel plating were discovered long before Madsen suggested their use. As early as the year 1882 a British patent[1] was granted covering the production of thick nickel deposits by so constituting the plating bath "that it forms an ether, an alcohol, or an oxygenated compound in such a manner that hydrogen produced in consequence of decomposition of water by the electric current is absorbed by the composition of the bath." Among the specific compounds mentioned were permanganic and manganic acids.

Thomas A. Edison was granted a patent[2] in 1910 on the use of chlorine gas as an addition agent in copper plating. In the specification, Edison disclosed as examples of his discovery the use of chlorine in copper sulphate and in cobalt chloride plating baths. O. P. Watts, in his summary[3] of nickel-plating literature for the American Electrochemical Society (1913), quoted Edison in the following words:

"The occlusion of hydrogen tends to make the deposit somewhat brittle and more or less porous, and hydrogen gas clings to the surface of the deposited metal in the form of very fine bubbles, thereby making the surface more or less warty and rough . . . By maintaining in the bath a small amount of material which will combine with free hydrogen, **e. g.**, chlorine, the occlusion of hydrogen, etc., is prevented . . . Free bromine may be used, but gives inferior results."

In an article entitled "Nickel Plating," which appeared in 1911, P. S. Brown[4] made the following statement: "The best remedy for pitting is to agitate the bath, preferably with air." Proceeding in chronological order, we next find A. Hollard (1912) recommending the use of sodium persulphate in nickel-plating baths[5]. He based his work on the theory that exfoliation of nickel in coating stereotype plates was due to codeposition of too much hydrogen with the nickel. He tried also at that time additions of potassium dichromate, ferric sulphate, sodium perborate, and hydrogen peroxide, but concluded that the best oxidizing agent of the lot was sodium persulphate.

Hogaboom (1916) pointed out that air agitation is useful in preventing, or at least reducing, pitting[6]. A few years later Hans Staeger (1920) suggested that small additions of H_2O_2, $KClO_3$, or $C_6H_5NO_2$, reduced the tendency of nickel deposits to contract and peel[7]. Still another use for hydrogen peroxide was disclosed by Rudolf Carl[8] in 1922. Carl recommended addition of hydrogen peroxide and finely powdered limestone to remove excess dissolved iron from nickel-plating electrolytes. M. Schloetter (1921) recommended the use of ammonium persulphate for a similar purpose[9].

It may be of interest that nickel plating solutions contaminated with iron, copper and organic matter, are purified in the International Nickel Co.'s Laboratory by adding a small excess of freshly precipitated black nickel peroxide slime, then agitating with air and filtering. Tests made here indicate that dissolved chlorine gas can be used to prevent pitting with some advantage in respect to retention of a high degree of ductility in thick deposits.

In view of the fact that the temperature and current densities employed in rapid nickel plating in the United States are considerably higher than those maintained by the authors in establishing the theory of the action of oxidizing agents, it would be of practical advantage to have an outline, however brief, of the influence of increase in temperature, current density, and degree of agitation, upon the concentration of oxidizing agent required to suppress discharge of hydrogen and upon the amount of the agent which produces unsound deposits.

*Discussion of a paper by Hothersall and Hammond contributed at a recent meeting of the Electrodepositors' Technical Society of London, England.

[1] Vandermersch, J. British Patent No. 5,300 (1882).
[2] Edison, T. A U. S. Patent No. 964,096 (1910)..
[3] Watts, O. P. **Trans. American Electrochem. Soc. 23,** 99 (1913).
[4] Brown, P. S. **Metal Industry** (N.Y.), **9,** 85 (1911).
[5] Hollard, A. **Bull. Soc. Enc. Ind. Nat.,** July (1912),, p. 24.
[6] Hogaboom, G. **Trans. American Electrochem. Soc., 29,** 372, (1916).
[7] Staeger, H. Helvetica Chim. Acta, **3,** 584 (1920).
[8] Carl, R. **J. Inst. Metals, 30,** 614 (1923).
[9] Schloetter, M. **Metal Ind.** (London), **19,** 447 (1921).

Fabricating Sheet Aluminum Articles

Q.—Please let us know how most effectively to solder small sheet aluminum articles in production.

A.—Some aluminum solders require fluxes or acids, and some do not. Some of the solders are so hard that the heat of a blowtorch must be used instead of a flame heated soldering copper. However, for production work an electric soldering iron would be considered a necessity. Scratch brushing with a clean wire brush is generally necessary to remove the oxide from the aluminum surfaces. The removal must be done while the surfaces are covered with molten solder; otherwise, any exposure to the air will cause new oxidation instantly.—**W. B. Francis.**

Ford Uses New Rustproofing Process

AN ENTIRELY new method of rustproofing which for the first time in the history of electrochemistry, utilizes alternating current in the process, has been perfected by the Ford Motor Company and is now being used in its entire production of head and tail lamps at the Ford lamp plant at Flat Rock, Michigan—the famous "factory in a meadow."

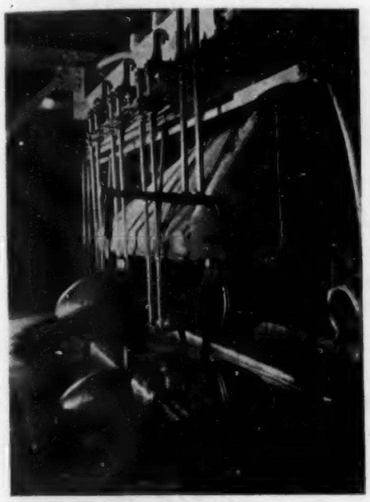


Fig. 1. A mounting of four Ford headlamp shells enter the automatic rustproofing bath. They remain in the bath 4½ minutes, in a solution of zinc phosphate and phosphoric acid at 150° F., and while in the bath are energized with an electric current density of 35 to 40 amperes per square foot of surface, a protective film .0005 inch thick of zinc phosphate being deposited. The bath shown is a converted nickel plating machine

The new process (called "Granodizing") is considered by Ford chemists as especially suitable for use in the Flat Rock operation, as it requires less room than other methods of rustproofing, and provides a surface which is ready for painting as it comes from the rustproofing machine. The only attention required before painting is to wipe off the surfaces to be painted with a clean cloth.

The process was developed first outside the Ford organization, but when it was given its first commercial tryout in the Flat Rock plant a number of difficulties developed. The most important of these was deterioration of the steel surface by acid action before the deposition of the rustproofing agent, **zinc phosphate,** began. This deterioration resulted in a sort of "alligator" surface on some parts of the treated article. It was finally overcome by discontinuing the elaborate washing operation which has preceded the actual rustproofing. Instead of washing the lamp shells in a machine they are made "dirty" by wiping the surface to be painted with a cloth impregnated with low-grade gasoline. This puts an oily film on the surface and by the time the chemical action in the rustproofing machine has removed this film the deposition of zinc is well under way and the desired smooth finish is obtained.

The efficiency of the rustproofing may be gauged from the fact that a minimum resistance to rust of 300 hours under salt spray is required by the Ford Motor Company for these parts. In actual laboratory tests complete resistance to rust after 1,000 hours of salt spray is being obtained. This is equivalent to years of ordinary use.

The rustproofing machine, or rather machines, for two units are in use, are entirely automatic. The burnished lamp shell, with its oily film is hung on a conveyor which carries it into the bath, where it stays for 4½ minutes. The bath is kept at 155° F., and an alternating current of 20 volts, pulling from 35 to 50 amperes at 60 cycles, alternately makes the article to be rustproofed an anode and a cathode.

The effect of this current, Ford chemists believe, is not to make the process one of electro-plating, but the electricity prevents the formation of hydrogen on the article being treated, and eliminates polarization. The result is that the steel is able to take its coating of zinc by chemical action without interference.

After 4½ minutes in the bath the conveyor takes the rustproofed articles to a hot water spray rinse and dip rinse, and then carries them to the paint booth, were they are dip painted at once afted being wiped off with a clean cloth.

If the alternating current were not used, it is stated, the deposition of zinc would be very thin and too crystalline, and a great deal of iron would be removed by the chemical action and go into the solution.

A feature of the process is that the proportion of metallic zinc in the bath can vary widely and still permit of satisfactory results. It is allowed to vary from 0.9 per cent to 0.2 per cent.

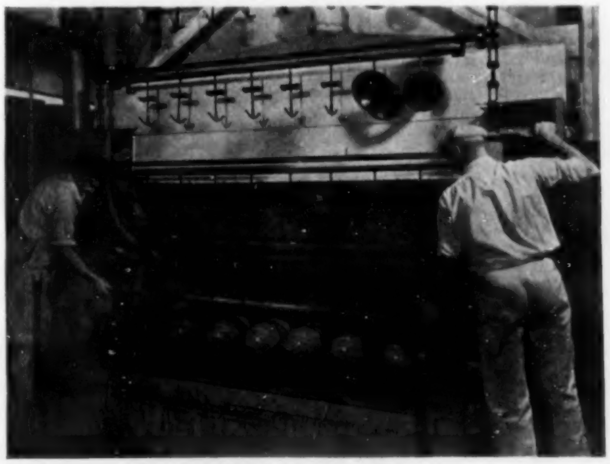


Fig. 2. Lamp shells come out of the rustproofing bath so smooth that they can be dip-enameled at once after a wipe over with a clean rag. The rack full of shells goes straight to the ovens from the enamel bath

The process is not thought to be suitable for large pieces, such as fenders, because the oily-wiping operation by hand is probably not economically feasible for very large articles. Rustproofing methods previously used are therefore being continued for large surfaces.

EDITORIALS

Business Progress

INDUSTRIAL activity in May was lower than in April, but a slight improvement was noted in June, according to the National Industrial Conference Board. June, 1935, was considerably above June, 1934. Steel production has been rising steadily for several weeks.

One of the bright spots at this time is the building industry. Residential construction has advanced sharply. Although total construction is 5.7 per cent below a year ago, this loss can be found in the reduction of publicly financed work during the past year. Private work has advanced 27 per cent over last year. Residential construction is 80.8 per cent above 1934.

Passenger car and truck production dropped in May, 24.7 per cent below April but it is still 7.7 per cent over May of 1934.

Another encouraging sign is the recovery in durable goods manufacturing which has proceeded more rapidly than in the non-durable goods industry. A study of employment, payrolls and earnings made by the Conference Board shows that the heavy industries are regaining lost ground fairly rapidly. They are still, however, far below the level of the consumer goods group, employment being 22 per cent under and payrolls 24 per cent under the corresponding figures.

The total number of unemployed workers in June was 9,804,000, an increase of 1% over May. Orders received by the General Electric Company during the first six months of 1935 amounted to $104,542,946 compared with $92,154,642 for the first six months of 1934. Sales billed during the first half of 1935 amounted to $94,546,274 compared with $80,983,094, during the same period of 1934.

According to the Business Bulletin of the Cleveland Trust Company, summarizing industry as a whole, industrial activity during the first half of 1935 has been somewhat better than during the first half of 1934. Improvement was due to the automobile industry and private residential construction. They point out an anomaly in the present situation, that is, the fact that we have a great accumulated shortage of goods and a great accumulated surplus of capital and comparatively slow business activity. Few existing businesses are failing, but almost no new ones of importance are being started.

According to the best general opinion, the prospects for 1935 are that industrial production will be better than in any of the past four years. It is still, however, far below "normal" business on an even keel. The strongest element to-day is the automotive industry; the weakest, new construction and furnishing of materials for the railroads.

More Standards and Specifications

ONE of the silver linings to our many present clouds, is the fact that good ideas are contagious as well as bad ones, and one of the good ideas which has been gaining ground rapidly even during these hard times, is standardization and specifications.

An attack on a new field was outlined by T. A. Wright in a survey of testing in the precious alloy field, read before the last meeting of the American Society for Testing Materials. Judging from his experience, the order of importance from the point of view of testing, would be gold, silver, platinum and rhodium. The tests to be applied would include assaying, analysis for formula, studies involving identity, character, thickness and distribution of plate and electroplate; tarnish corrosion and wear corrosion; hardness, ductility and springiness. Mr. Wright laid a foundation for the standardization of tests of gold-clad or Duplex materials.

The field is complicated. It covers a myriad variety of articles. The uses are legion. Design, color, appearance, etc., are often of the highest importance, and yet the precious metal is the cornerstone of the product.

Standards, specifications and standardized methods of testing in such a variegated field will be difficult. Responsible members of these industries would welcome them, however. The need is great and the work should be undertaken.

The Machine and the Man

A FAVORITE topic of parlor economists is the devastation caused by the machine. When we were prosperous, the machine dulled and deadened the finer senses of the workers. During the past five years, the machine has been the devil which has caused unemployment. To a dishearteningly large extent these arguments have been pressed on guesses, hearsay and partial, misleading statistics.

An interesting survey was recently made by the National Industrial Conference Board for the National Machine Tool Builders Association, which has brought to light facts disproving many such half-baked assertions.

The total population of the United States rose from 38,500,000 in 1870 to 122,700,000 in 1930. At the same time the population gainfully employed increased from 12,505,923 or 32.4 per cent to 42,829,920 or 39.8 per cent during those 60 years. In other words, the working population grew faster than total population. This period was marked by rapid technologic improvement, the wide introduction of labor-saving devices and enormous mechanization of industry.

How then did the machine which is said by nature to throw labor out of employment, fail to stop this rise? The answer is simple. Eighteen new industries were created by advances in science, invention and technology. The outstanding example, for size, is the automobile industry, which employs about 450,000 workers. Electrical machinery took 328,000 workers. Space does not permit listing all of the new manufactures, but they range in size down to fountain pens, which employ 4,500 workers. The total employed directly in these new industries is about 1,125,000.

This figure, however, does not adequately represent the total increase in jobs created. Millions of workers have been recruited in such industries as public utilities, transportation and distribution required for the marketing of goods and services, and huge increases in the volume of employment have resulted in the established industries supplying raw materials or basic manufactured commodities required in the production of these new products.

Moreover, it must be constantly borne in mind that these new industries would have been impossible without improved machinery. In other words, the machine, while it has replaced workers in the specific industries in which it has been introduced, has been directly responsible for the creation of new industries, and the enlargement of old, which not only made places for the displaced workers, but called for additional millions.

One of the interesting sidelights of the study mentioned above is that it shows mechanization in industry to be not as widespread as many people believe. The average horse-power per wage earner used throughout all manufacturing industries rose from 2.11 to 4.86 between 1899 and 1929. However, there is a range among the different industries, from a high of 13.6 H.P. per worker in paper and allied products down to 1.4 in leather and its manufactures. To picture the amount of added machinery which might be required, we have only to imagine industry as a whole raised to the figure of 10.4 shown by iron and steel.

There is clearly room for mechanization to an extent which we have not yet approached.

Copper is Steady

THE break in copper during the last of June from 9 to 8 cents was followed immediately by a similar drop in the prices of fabricated copper and copper alloy products. It left the industry holding its breath, anxiously waiting for the possible plunge. The Code was dead, legal control methods were out. Agreement among producers seemed impossible. What would be next?

The past three weeks have been rather reassuring. Copper producers have shown a considerable resistance to further price-reduction. The statistical position of the metal has improved since the first of the year, stocks having been reduced from 350,000 tons to about 270,000 tons. The tariff of 4 cents on copper imports has been extended to July 1st, 1937, which will protect the American metal from the vagaries of foreign markets.

The future is not clear by any means, and there is still hesitation about buying in quantity. According to Standard Statistics, however, there is no present discoverable trend to step-up production. The statistical position should remain as good as or better than it is at present. A Fall increase in general activity is certain to increase the demand for copper and the metal is in a good position to profit by it.

What is Ahead?

THERE is no more accurate way of predicting what is coming in industrial development than to find out what consumers are asking for. To be sure they may ask for everything and anything under the sun, but by and large what the great body of consumers want, sooner or later they get.

What do manufacturers and the public want in metals and metal products? Too often they want the equivalent of a Rolls Royce for the price of a Ford, but in many cases their demands are worthy of serious thought. At the recent meeting of the American Society for Testing Materials, the symposia on automobiles and housing uncovered the demand for better and less costly light alloys. They disclosed the greatly increased use of aluminum and copper alloys in housing relative to steel, but more as exterior and interior finishing elements than in the structural parts. They presented evidence of a demand for higher purity and uniformity in metals, which has resulted in a greatly widened use of spectrographic analysis.

These are only a few and seemingly divergent reactions, but they have one element in common—better materials at lower cost.

An old story? Perhaps. But it is a story that will never die of old age. In good times as well as ! in any progressive, active, forward-looking organization or society, that demand will continue to face the producer, plague the inefficient and reward the ingenious. Better Materials at Lower Cost.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

ASSOCIATE EDITORS

METALLURGICAL, FOUNDRY, ROLLING MILL, MECHANICAL, ELECTRO-PLATING, POLISHING, AND METAL FINISHING

H. M. ST. JOHN W. J. PETTIS W. J. REARDON W. B. FRANCIS
G. BYRON HOGABOOM T. H. CHAMBERLAIN WALTER FRAINE

Brass Analysis

Q.—Please analyze the sample of our brass solution which I am sending you.

A.—Analysis of brass solution:

Metallic copper	2.02 ozs.
Metallic zinc	.74 oz
Free cyanide	2.47 ozs.

The zinc content is too high for the copper content. We would suggest that you add 40 lbs. of copper cyanide and 40 lbs. of sodium cyanide to the solution. Operate the solution at 80° F. and if the color is too red, add 26° ammonia until proper shade of color is produced.

Problem 5,406.

Copper Solution Analysis

Q.—Am sending with this letter under separate cover, sample of present acid copper solution. I am using it to metallize a non-metallic (galvanizing deposit). I am very anxious to know the constituents of this bath as I did not mix it. The bath works very nicely with the exception that we get a rough deposit now and then. As far as I know the bath contains copper sulphate, sulphuric acid, water, a nickel salt, (?), corn syrup (?) and water. The amount of each, I don't know.

Would you kindly analyze this sample and send to me at your very earliest opportunity.

A.—Analysis of acid copper:

Metallic copper	8.44 ozs.
Sulfuric acid	3.29 ozs.

The metal content is somewhat too high as it is equivalent to 34 ozs. of copper sulfate per gallon. When increasing the volume of solution, use 28 ozs. of copper sulfate and 3 ozs. of sulfuric acid to each gallon of solution that is added to the present solution.

The use of addition agents such as nickel salts, corn syrup, aluminum sulfate, and others, is not necessary, and we do not advise their use. If the deposit is rough, then filtration is necessary to remove the metallics from the solution and prevent the roughness.

Problem 5,407.

Cyanide Copper

Q.—I am copper plating parts which are to be pack hardened by heating to 1650° F. after plating. If the parts are to remain soft after hardening I must have a very good job of copper plating to prevent the penetration of carbon. I am using a 10 gal. crock with a single cyanide solution using electric bus-bars for anodes. I expect to have my solutions analyzed for metallic copper, cyanide and hydrogen ion concentration and would like you to advise me as to the best concentration of copper and cyanide for operation of the solutions at room temperature; also if the copper or cyanide be too high or too low advise me what steps to take to correct their concentration; also the pH.

I have not been paying much attention to analyzing the solutions and have had some trouble with the copper failing to prevent the steel from taking up carbon during the carburizing or pack hardening operation. This has resulted in loss of work because these places became excessively hard after quenching and cracked.

I expect to use the methods for analyzing given in the 1935 edition of Platers' Guidebook.

My present solution was made up some time ago and was

USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION

Fill in all items if possible.

Date..........................

Name and address: ....**Employed by:** ....
Kind of solution: ....**Volume used:** ....
Tank length: ....**width:** ....**Solution depth:** ....
Anode surface, sq. ft.:...**Cathode surface, sq. ft:** ....
Distance between anode and cathode: ....**Kind of anodes:** ....
Class of work being plated: ....**Original formula of solution:**...

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible.

Use separate sheet if necessary. ______________________________

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NOTE: Before taking sample of solution, bring it to proper operating level with water: stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail to METAL INDUSTRY 116 John Street, New York City.

made up with copper carbonate, sodium cyanide, and hyposulphite of soda and water, but I have misplaced the record as to just what amounts were used at the time.

I expect to keep this solution in first class order by making periodic analyses for metallic copper and cyanide contents and if you will advise me as to just what concentrations of these elements produces the best results for case hardening this will be appreciated. I expect to use the solutions at room temperature, however, if you will please give me the correct conditions for 100° F. also, together with the general method for correcting the concentrations this will be appreciated; also the pH.

A.—A cyanide copper solution to be used for your purpose should be operated at 120° F. for best results.

The metal content should be kept around 3 ozs. per gallon, and the free cyanide 1 oz. per gallon with the addition of just enough hyposulphite of soda to produce a clean, uniform deposit.

The solution is quite easy to operate and if the constituents of the solution are kept at a standard as given, no trouble will be encountered. Problem 5,408.

Etched Dials

Q.—Am enclosing an etched dial, filled in with white enamel excepting in certain portions which are oxidized along with the background.

1. How is the enamel filled in without getting it into those parts which are to be oxidized?
2. How is this background treated before oxidizing?

I am anxious to discover the proper method of making this type of dial as we will be expected to make quite a number of similar ones. Our present method is slow, tedious and exceedingly uncertain of good results.

A.—The following procedure was used to finish the sample dial. The even surface is produced by using 4 ozs. of bichromate of soda and 12 ozs. of sulfuric acid to one gallon of water. Plate in cyanide copper for a flash deposit and then black nickel plate.

After black nickel plating apply resist and then etch. The enamel is then sprayed upon the numerals and letters, using a stencil after which the resist is removed and then sprayed with a coat of lacquer. Problem 5,409.

Heavy Copper Deposit

Q.—Would like to deposit a layer of copper, inch thick in an acid solution. I have found in the past that whenever three volts were used in order to get a rapid deposition the metal became brittle and unevenly deposited. I know, however, that there is a method in present use by means of which quick deposition can be made, which is nevertheless very smooth. Can you inform me of the following facts?

1. What process should I use in getting the quickest though very even deposition?
2. What voltage and amperage should I use in this process?
3. What is the formula of the copper acid solution?

A.—

Copper sulfate	28 ozs
Sulfuric acid	3½ ozs.
Water	1 gallon

The solution should be operated at room temperature with cathode or air agitation, using 1 to 1½ volts with 10 to 15 amperes per sq. ft.

Filtration of the solution will be necessary to produce a smooth deposit of the thickness desired.

Problem 5,410.

Silver Analysis

Q.—Please give us the analysis of our silver solution; sample under separate cover.

A.—Analysis of silver solution:

Metallic silver	4.05 ozs.
Free cyanide	5.50 ozs.

Increase the free cyanide by adding 2 ozs. of sodium cyanide to each gallon of solution. Problem 5,411.

Silvering Auto Reflectors

Q.—Please give us some information on how to silver auto reflectors so that we can compete with new ones. New Ford V8 reflectors sell for 50c each. Please give the formula that you recommend for this type of work. Also advise if Sterling anodes will work, that is Sterling silver scrap will work for anodes. Also, is there any way to dissolve silver in cyanide and use this instead of silver cyanide?

A.—The method of silver plating automobile reflectors is to nickel plate for 5 to 8 minutes, then silver strike for 30 to 45 seconds and then silver plate for 5 minutes.

The polishing cost is the greatest item in refinishing this class of work and for the price given there would certainly be very little profit, if any, to the jobber.

We would advise you to purchase the silver cyanide instead of making it yourself and while sterling silver may be used for anodes for this class of work silver anodes .999 are recommended to be used. Problem 5,412.

Silver Solution

Q.—Am shipping by parcel post an 8 oz. sample silver solution and would like an analysis and advise on same.

A.—Analysis of silver solution:

Metallic silver	2.55 ozs.
Free cyanide	6.55 ozs.

Analysis shows that there is nothing wrong with the solution and if trouble is encountered look to the current density used. Problem 5,413.

Strips for Gold and Nickel

Q.—Would you give me formula for a cold gold strip with a reverse current; also a strip for nickel (die cast).

A.—Formula for gold strip:

Sodium cyanide	8 ozs.
Potassium ferrocyanide	2 ozs.
Rochelle salts	2 ozs.
Copper cyanide	2 ozs.
Water	1 gallon

Nickel strip for die cast:

Sodium cyanide	12 ozs.
Caustic soda	4 ozs.
Water	1 gallon

Use at or near boiling temperature with 6 volts, reverse current. Problem 5,414.

Watch Dial Finishes

Q.—Am enclosing watch dials and I am in hopes you can assist me to obtain these finishes. I refinish dials but have been having some trouble duplicating finishes. I have tried to duplicate No. 1 sample by applying precipitated silver powder and cream of tartar, salt, but there is something wrong with process and portions, etc. It comes out shiny and streaked.

I am also very much interested in producing the egg shell or sample 4.

No. 1. Swiss Brass.	No. 3. Nickel Silver.
No. 2. Brass.	No. 4. Silver.

Please return samples.

A.—The sample dials have been finished as follows. In finishing No. 1, etching in an iron chloride solution is used to produce the dull surface. Silvering by the cream of tartar and silver powder is the next operation. The dial is then lacquered and the letters and numbers are surfaced.

No. 2 is finished the same way with the exception of the numbers and design which are printed on after silvering.

No. 3 is a nickel silver base metal and the finish is produced by using a very fine grade of emery cloth to obtain the dull effect and then silver plated.

The etched surface on No. 4 is produced by using 1 part of nitric acid and 4 parts of water and used warm. It has also been silvered, using fine silver powder and cream of tartar and the letters and numbers are printed. Problem 5,415.

Equipment

New and Useful Devices, Metals, Machinery and Supplies

The Mark of Quality on Electroplate

By SAM TOUR

Vice-President, Lucius Pitkin, Inc., 47 Fulton Street, New York

"Measured - Quality - Products Testing Service," Developed by Lucius Pitkin, Inc., and approved by the Masters Electroplating Association of New York.

Objectives

1. To encourage and facilitate the production and sale of electroplating of **some** known and stated minimum thickness and quality.
2. To furnish a testing service which will assist the electroplater in producing work of a known and definite quality and which will check on his ability and intent to produce work of such character.
3. To provide an impartial agency to certify as to the ability and record of any producer of electroplating in the production of plating of a known and definite quality.
4. To make simple, inexpensive and systematic tests on actual production work for both buyers and producers; and in other ways to promote the use of "Measured-Quality-Electroplating."

"Measured-Quality-Products Testing Service" offers the operator of a polishing and plating plant or department a systematic check on the efficiency of his operations and on the quality of his production in an inexpensive manner; and yet in the most accurate manner short of making actual physical tests and measurements of each article plated.

It gives him precise information regarding the efficiency and throwing power of his solutions, on the thickness, adherence and porosity of his deposit, and on the effectiveness of his cleaning operations. It gives it to him in such form that it is not only useful for his own guidance, but is actually a certification by a reputable and impartial organization as to his ability and sincere intent to furnish electroplating of a definite, measured standard of quality.

Subscribers to this service are expected to specify on their invoices the minimum standard of quality for the work furnished and to include with each invoice a "Measured-Quality-Products Certificate" of current date. This does not mean that they are to sacrifice any competitive advantage by adhering to any specified thickness of deposit. The purchaser in general is not quite ready for that yet. For their own advantage subscribers are to specify on the invoice whenever possible the minimum thickness below which the work in that lot will not fall. The cut-price competitor is often also a cut-quality competitor. By boldly coming out with a provable statement of the quality of his work, and offering an easy and inexpensive method of proving it, the ethical electroplater sets a standard to which the purchaser will not be slow in making his competitor come up.

The Sponsors of this Service believe that the future of the Electroplating Industry depends upon the general adoption of "Measured-Quality-Electroplating." It is recognized that, with the exception of a few large buyers, the purchasers of electroplating are only just beginning to become "specification-conscious," and that the thickness of a plate in fractional thousands has little meaning to them. There are very few buyers, however, who want to buy an unknown quantity if they can help it. Users of electroplating will be shown the advantages of buying "Measured-Quality-Electroplating" and it will be made both easy and inexpensive for them to obtain frequent analyses of the deposit given their product.

The Service will be of real dollars and cents value to the ethical and able producer of electroplating. It will be a poor investment for the chiseler even if he succeeds in obtaining the Service. The subscriber to this service must not only agree to the immediate cancellation of his contract, and use of the seal and certificate, and of all other rights and privileges under his contract upon the slightest evidence of any subterfuge upon his part; he must further agree to invite the submission by his customers of representative samples of his production work for testing and report, with the understanding that in any case where the work does not meet specifications he, the producer, will be responsible for all costs and charges.

The economy and simplicity of the Testing Service is largely due to the use of the "Measured-Quality-Discs"—specially shaped metal discs of scientific design which are polished and plated at periodic intervals **along with the regular production work.** These discs are furnished to the subscriber as required, to be processed and returned for testing and report. The characteristics of the deposit given the disc, and the effectiveness of the various cleaning and plating operations used, are then determined by the novel testing methods developed in the Pitkin Laboratories through their years of experience with such testing work.

"Measured-Quality-Disc" tests will be made at least four times per month. A report, covering the thickness, porosity and adherence of the deposit and the throwing power of the solutions used, will be prepared and sent to the subscriber after each test; and, if the result of the test plus other information regarding the subscriber is satisfactory, "Measured - Quality - Products Certificates" of current date will be issued to him as proof of his ability and performance in the production of "Measured-Quality-Electroplating." These certificates are for his use with his customers and will contain information to users of electroplating on the benefits to them of buying plating of a known and definite quality.

The Service will offer, to the electroplater who has the ability and the desire to do quality work, new opportunities to sell something besides "price." It will make it easier for him to put his chiseling competitor "on the spot." It will present to the purchaser of electroplating the first really simple and yet dependable method of determining just what he is buying.

Magnus Exhibit in Paris

Below is an illustration of the booth at the recent Paris Fair of the Magnus Chemical Company of Garwood, N. J.

It is the booth of Monsieur Marcel Boss, Ets. Mabor, Paris, who is in charge of the French factory and European sales of Magnus materials.

Magnus Exhibit in Paris

Polishing Research Laboratory

The Lea Manufacturing Company, Waterbury, Conn., has set up a new research and testing laboratory.

Dr. Henry L. Kellner and George C. Muscio who appear in the illustration below, are in charge of the work.

New Lea Metal Polishing Laboratory

Standard Extra Wide Swing Polishing and Buffing Lathe

The Standard Electrical Tool Company, 1928 West Eighth Street, Cincinnati, Ohio, are now offering their Proper Speed buffing and polishing machine with an extra wide swing, as shown in the illustration.

Extra Wide Swing Lathe

This machine can be furnished with a 10 or 15 HP ball bearing motor and is a supplement to their line of variable speed buffing and polishing machines of 3, 5, and 7½ HP sizes.

The overall length of the spindle is 108" and the 29" distance between the base and inside of the wheel provides ample room for the finishing of unusually large parts. The spindle is mounted in four oversize precision ball bearings, the bearings being located in labyrinth sealed chambers, preventing the possibility of foreign matter entering the bearings. The motor is mounted on a hinged bedplate inside the base and hand adjusting screw permits easy raising and lowering of the motor to take the tension on the belts. Variation of spindle speed is determined by the diameter of the pulley on the motor shaft. The power is transmitted from the motor to the spindle by "V" belt drive. The renewing of belts requires but a few minutes, as the entire spindle assembly may be removed intact without disturbing the bearing mountings.

A magnetic starter having overload and under-voltage protection is located inside the base and is operated through a control switch. A hand brake is conveniently located at the front of the machine and actuates the motor control switch, disconnecting the motor when the brake lever is pulled forward to apply the brake. When the hand brake lever is moved rearward, the brake is released and the circuit opened.

The net weight is 1,570 pounds.

New Developments in Rubberizing

That there is a need for rubber covering for a great variety of purposes has been recognized for several years. However, the rapid extension of such usage or practice has been prevented by the difficulty of developing a product which could be easily and economically applied by the purchaser and yet give satisfactory results in service.

Now a rubber in liquid form, and a rubber in plastic form, also are being offered which fulfilled the above requirements and which is said to have proven satisfactory in several years test by some of the largest industrials in the country.

The application of this new liquid rubber called "Self-Vulc" has, it is claimed, recently been improved by the development of a new priming compound, which makes good results possible by the application of a single priming coat; and both the priming and liquid rubber can be applied just like paint—brushed on, sprayed on, dipped on, or poured on. The rubber, it is stated, vulcanizes itself when exposed to the air.

"Self-Vulc" plastic is applied with a spatula or other flat tool and like the liquid, requires only one prime or preliminary coat and vulcanizes itself cold, when exposed to the air.

"Self-Vulc," liquid or plastic, is recommended for the following general purposes:

1. To protect inside and outside surfaces against
   - A—Abrasion
   - B—Corrosion
   - C—Acids
2. To restore surfaces of all kinds of material which have been worn away by abrasive action, acids and their fumes.
3. To water-proof or corrosion-proof all kinds of containers and surfaces.
4. To absorb shocks on surfaces subjected to impact, and thus prevent bending and breakage as well as abrasion.
5. To silence noises.

"Self-Vulc" liquid and "Self-Vulc" plastic are sold by the Self-Vulcanizing Rubber Company, Inc., Room 513-F., 605 West Washington Boulevard, Chicago, Illinois.

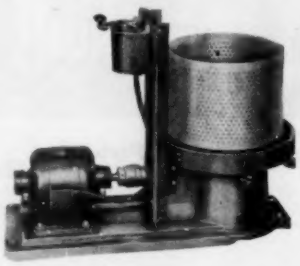
Fast Drying for Plated Parts

Compactness, efficiency and speed in drying basket loads of plated work are the features claimed for the New Mercil Type Centrifugal Dryer recently introduced by Hanson-Van Winkle-Munning Company, Matawan, N. J.

Available in two dryer shell sizes—12" x 12" and 18" x 18"—this dryer is especially recommended for use in conjunction with plating barrels as the small floor space required—17" x 33"—allows it to be set close to the barrel. Transfer of work is a simple operation and pieces to be dried may be placed directly in the perforated shell or in a separate basket which fits the shell.

Power for driving the turntable at 600 R.P.M. is obtained from a ½ H.P. motor through a pair of bevel gears. Four roller bearings of ample size support the drive shaft and turntable without end play, reducing friction and vibration to a minimum. Adequate lubrication is provided by running the gears in a bath of absorbed oil which also circulates through to the bearings.

A conveniently located reversing switch allows the operator to control the direction of rotation at will. It is not necessary to bring the basket to a stop before operating the reversing control.



Mercil Type Centrifugal Dryer for Drying Basket Loads of Small Parts—Fast, Economical, Vibrationless

The Udylite Handiplater

The Udylite Company, 1651 E. Grand Boulevard, Detroit, Mich., has developed a new, low cost unit for plating the small occasional lots of work, which often disorganize the production plant. This unit is called the "Handiplater" and can be used for cadmium, copper, nickel, tin or zinc plating.

The cylinder is detachable and has a capacity up to 25 pounds. The unit is motor-driven, powered by 1/6 H.P. motor. It can be operated by plugging into a light socket, and as shown in the illustration, which takes up little floor space.

The most important advantage claimed for this machine is flexibility. For example, to change from cadmium to copper plating, rinse the cylinder well with water to remove the cadmium solution and replace the cadmium anodes in the basket with copper. The removal of the anode basket and solution converts the cylinder into a machine for drying or tumbling.

Udylite Handiplater

Kote-Rax Covering

Hanson-Van Winkle-Munning Company, Matawan, N. J., announce Kote-Rax, a non-contaminating, corrossion-resisting coating for plating racks.

Applied by dipping, Kote-Rax covers the rack with a touch, rubber-like film possessing high dielectric resistance and capable of withstanding considerable mechanical abuse. Extensive tests, it is said, indicate that it is not affected by immersion in the common solutions used in the following plating baths: Chrome, nickel, cadmium, zinc, copper, brass, silver, tin, etc. Kote-Rax also withstands the action of solution encountered in connection with the above plating operations. Racks protected by this coating have been used as long as two months without showing signs of deterioration. Old racks as well as new can be treated satisfactorily.

Kote-Rax must be heated for use in non-metallic tanks. The average application consists of four dips at 230° to 260° F. It does not adhere to the metal but holds its position by shrinkage.

A complete Kote-Rax service is available for the larger plating shop. Job platers in strategic cities will be equipped to coat racks for consumers who will not have a sufficient number to warrant installation of rack coating equipment.

Mercil Type Burnishing Barrel

Several exclusive features mark the Mercil Type Burnishing Barrel recently introduced by Hanson-Van Winkle-Munning Company, Matawan, N. J. Extensive use of electro-welding and the use of anti-friction bearings throughout make possible a machine combining lightness, strength and durability. The burnishing barrel proper, gearing and motor are combined in one unit. Operation at any angle is quiet and efficient and the angle may be changed while the machine is running. Motor, gears and most of the cylinder are covered by a steel shell making the apparatus splash-proof. Safety guards, demanded by the Factory Commissions in most states are unnecessary with this machine.

Mercil Type Burnishing Barrel with Improved Cover Lifting Device. Motor, Gears and Barrel are Mounted in One Unit Protected by a Splash Proof Steel Shell

Operation is exceedingly simple. A motor control switch is mounted on the front of the frame. Notched plates on the right hand trunnion bearing lock the barrel at the desired angle. A unique cover lifting device and support facilitate handling the machine and the work.

Metal Products Exhibit Opens September 1

On September 1, 1935, a permanent exhibit of alloys, ferrous and non-ferrous metals, and plastics will be opened by Metal Products Exhibits, Inc., in the new International Building, Rockefeller Center, New York.

This exhibition has been designed specifically to assist industrial executives, engineers, designers, production managers, and buyers to improve the quality of their products, cut costs, and develop new products.

They will find a comprehensive display of metallic and plastic raw materials, a great variety of finished and semi-finished parts, metal finishes of all types, product sequences showing machining, fabricating, and heat-treating processes,

and many suggestions for designing and styling.

They can secure information on the properties, applications, and sources of supply of any kind of metals and plastics —old and new American and foreign—so that they can quickly solve immediate production problems and can keep their knowledge of these large, complex, and ever-growing groups of materials up-to-date.

All who are concerned with the specification and purchase of industrial materials will be welcomed at the Metal Products Exhibit, and all of its services will be rendered them free of charge.

Rockefeller Center, where the Metal Products Exhibit is located, is now one of the principal business and amusement centers of New York City. The Exhibition occupies the entire third floor of the International Building, the latest addition to the great Rockefeller building program, which is located on the corner of Fifth Avenue and 51st Street, and is readily reached by every New York transportation system.

Opening from the foyer is an auditorium, which seats several hundred people and is used for meetings by organizations concerned with industrial materials. Next to the auditorium is a library containing files of the catalogs of all manufacturers in the metals and plastics industries. These catalogs are completely cross-indexed so that any information they contain can be readily located. Trade and technical magazines and books on the technology of industrial materials are also available in this library.

From the foyer, the visitor enters the exhibit space which occupies the entire third floor. Facilities are available for exhibiting products of any kind from small samples showing finishes to large castings and forgings.

Finished products, as sold to the ultimate consumer, will not be shown except as illustrations of the applications of materials and finishes. Nor will processing machinery be exhibited, but processes will be demonstrated by means of product sequences.

Catalogs

The Why and How of Bronze Powder. O. Hommel Company, Pittsburgh, Pa. (393)

Quarterly Price List. R & H Chemicals Department, E. I. duPont de Nemours and Company, Inc., Wilmington, Dela. (394)

Chemicals, Spray Products, Cadalyte, Zinc. Grasselli Chemical Company, 629 Euclid Avenue, Cleveland, Ohio. (395)

Alcoa Aluminum and Its Alloys. A booklet presenting in concise form some of the fundamental information concerning the alloys which are produced by the Aluminum Company of America, Pittsburgh, Pa. (396)

Chemical Analysis of Aluminum. Methods standardized and developed by the chemists of the Aluminum Company of America under the direction of H. V. Churchill and R. W. Bridges. Obtainable from the Aluminum Research Laboratories, Box 772, New Kensington, Pa. Price 50 cents. (397)

The Battery Industry at a Glance. A reference guide and a source of valuable information on the statistics of this important industry. National Battery Manufacturers' Association, Inc., 7 E. 44th Street, New York. (398)

Buffing and Polishing Methods. A reference book and instruction manual containing a complete description of the Lea methods of finishing. It describes also various phases of the art of buffing and polishing and the different products, compositions, etc., made by the Lea Manufacturing Company, Waterbury, Conn. Price $1.00. (399)

Microscope Accessories. Bausch & Lomb Optical Company, Rochester, N. Y. (400)

Stewart Gasifier. For any industrial gas-fired furnace; reduces fuel cost. Chicago Flexible Shaft Company, 1250 S. Central Avenue, Chicago, Ill. (401)

Art Metal Crafts and Tools. Linoleum, block printing, leather craft, wood carving and model making. A complete catalog of all the tools used in these industries. William Dixon, Inc., Newark, N. J. (402)

Metal Spraying Equipment for General Maintenance Applications. Metallizing Company of America, Inc., Box 822 Arcade Station, Los Angeles, Calif. (403)

Sales Manual for Porcelain Enamel. Porcelain Enamel Institute, Inc., 612 North Michigan Avenue, Chicago, Ill. (404)

Lead Pipe. A 24-page illustrated booklet containing more up-to-date information on lead pipe and lead plumbing supplies than any other treatise; new standards for lead pipe. Lead Industries Association, 420 Lexington Avenue, New York. (405)

Brush Phase of Motor Maintenance. Second edition of this recently issued booklet, brought up-to-date. Ohio Carbon Company, 12508 Berea Road, Lakewood, Ohio. (406)

Subversion of the Dollar. By E. S. Pillsbury, president, Century Electric Company, St. Louis, Mo. Other treatises available on the same subject are **English vs. American Monetary Systems,** and **How the Dollar Was Undermined.** (407)

Stevens Automatic and Semi-Automatic Plating Equipment for Any Process—For any Product. A comprehensive catalog describing and illustrating automatic machines for plating tin, nickel, copper, zinc, cadmium, silver, chrome; also for cleaning, pickling, lacquering, enameling, etc. Frederic B. Stevens, Inc., Larned and Third Streets, Detroit, Mich. (408)

Instruments of Precision. X-ray diffraction; fatigue of metals. Scientific Appliances, Inc., 209 N. Broadway, Urbana, Ill., factory sales office of the J. B. Hayes, Inc., Urbana, Ill. (409)

Industrial Head and Eye Protection; shows a number of new and improved products. Chicago Eye Shield Company, 2300 Warren Boulevard, Chicago, Ill. (410)

Lea Acid Ejector. Lea Manufacturing Company, Waterbury, Conn. (411)

Condor Whipcord Endless Belt. The Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc., Passaic, N. J., has just issued a new descriptive bulletin on their Condor Whipcord brand of endless transmission belting. In addition to the descriptions, specifications and sectional and installation views of the product, the bulletin contains valuable technical data on how to determine properly the length of endless belts and also horsepower tables. (412)

Directory of Manufacturers of the New Haven District. Manufacturers' Division New Haven Chamber of Commerce, New Haven, Conn. (413)

Save time. Use the coupon below to get any of the above catalogs or bulletins, or for data on any subject not mentioned this month. METAL INDUSTRY will see that you get them promptly.

METAL INDUSTRY
116 John Street, New York.

(Insert below the number in parentheses at end of each item desired.)

I wish to receive the following catalogs mentioned in August, 1935

....

....

Name .... **Address** ....

Associations and Societies

Non-Ferrous Foundry Association

47 Fulton Street, New York

The following is a summary of the action taken at a meeting of the Board of Directors as held in Detroit on June 28th, 1935:

1.—The Code Authority has been dissolved.

2.—The Association is continuing.

3.—The Association has a net cash balance.

4.—Expenses of operation have been greatly reduced.

5.—Entrance Fees to the Association have been suspended until further notice.

6.—Dues to the Association will be at the very low rate of 50c per ton of rough castings produced for further processing or delivered to the customer.

7.—Minimum dues will be $2.50 per quarter.

8.—Maximum dues will be $100.00 per quarter and include all plants of a corporation.

9.—The Association will reimburse the Local Chapters for all actual expenses incurred prior to June 15th, 1935.

10.—Local Chapters are free to arrange for local dues or contributions at their discretion.

11.—An Annual Meeting of the Association is to be arranged for.

12.—The Cost System is to be revised and simplified.

13.—The Association will endeavor to keep in touch with, represent the Industry and keep members informed on—

(a)—State Labor Compacts on Minimum Wages and Maximum Hours,

(b)—Workmen's Compensation and Unemployment Insurance,

(c)—Prison Labor Competition,

(d)—Silicosis,

(e)—Medical Treatment.

14.—The Association will gather statistics on employment and sales and will endeavor to determine the trends in the Industry and keep the members informed.

Detroit Branch, A. E. S.

c/o T. C. Eichstaedt, 77 Pingree Avenue

A regular meeting of the Detroit Branch, American Electro-Platers Society was held at the Hotel Statler, Detroit, Michigan, Friday evening, June 7th, at 8:00 P. M. Col. Hansjosten presiding. After the routine business, the installation of officers took place, Col. Hansjosten performing the duties of Installation Officer very well.

Charles Eldridge was appointed by our new President, **W. W. McCord,** as Chairman of the Program Committee for the ensuing year. As Chairman of this Committee, **Mr. McCord,** as well as the whole Society, hope he will do as well as he has done in the past in this capacity. However, in order to help Mr. Eldridge, and not drop all the work upon his shoulders, the following were also appointed on this Committee: Messrs. **Lewis, Cherry, Soderberg, Kirby, Nankervis** and **Southwick.**

In the Question Box, which was then taken up by our new Librarian, **Chester Marshall,** were found two questions:

Q: "How long may a nickle solution PH about 5.7 be stored in a steel tank without picking up iron in harmful amounts?"

A: "72 hours without much pollution of iron."

Q: "Of what importance is anode current density in a nickle solution?"

A: "High current density gives a rough deposit. A low current density is safe. Current density is governed by chloride content in solution."

The meeting adjourned at 9:30 P. M., until the first Friday in September.

American Electro-Platers Society

c/o E. S. Thompson, 905 W. 10th Street, Erie, Pa.

Late information concerning the activities at the Annual Convention in Bridgeport, June 10-13th, includes the following items of interest:

The Founders Gold Medal for the best paper was awarded to **W. M. Phillips,** as stated in our July issue.

Second Prize was awarded to **W. Castell,** Anderson Branch.

Third Prize went to **A. J. Lupien,** Detroit Branch.

For Exhibits

First Prize—E. G. Stenberg, Chicago Branch.

Second Prize—W. E. Bancroft, Hartford Branch.

Third Prize—W. M. Phillips, Detroit Branch.

Machine Tool Show

The largest exposition of machinery ever held in the United States opens September 11 in Cleveland under the sponsorship of the National Machine Tool Builders' Association, it was announced at the offices of the Machine Tool Show, 232 Madison Avenue, New York City. The Show will continue for 10 days.

More than 235 exhibitors will participate in the exposition and will display machines ranging from those that fashion the tiniest parts of a lady's watch to giant mechanisms that produce parts for the mightiest battleships, as well as accessories, lubricants and related products. The total value of the exhibits will be approximately $4,000,000.

The 1935 Show will be about 50% larger than the last exposition, held in 1929. It will occupy about five and one-half acres of exhibit area, the entire available space in Cleveland's Exposition Hall and Public Auditorium. Most of the space was sold within three weeks after the exposition was announced, and additional area was laid out to accommodate the needs of prospective exhibitors from outside the Association. It is estimated that 5,000 kilowatts of electrical energy will be required to pull the hourly load when the machines are under power.

The Show will be America's first review of her own primary mechanical efficiency since the beginning of the depression and will be a preview of mechanical preparedness for the future. Improvements in machine tool design, precision and capacity during the last five years have exceeded the cumulative advances of the preceding twenty years, according to the Machine Tool Builders' Association, and the 1935 Machine Tool Show will display for the first time a number of products which are expected to revolutionize mechanical production methods.

Roberts Everett Associates are the exposition manager.

British Institute of Metals

36 Victoria Street, Westminster, London, S. W. 1, England

The following is a complete list of the Papers that have been offered for the Autumn Meeting to be held September 9-12, 1935 in Newcastle on Tyne, England:

Chaston, J. C.: "Note on the Effect of Interrupted Straining on the Elongation of Lead."

Owen, Professor E. A. and **Joseph Rogers:** "X-Ray Study of Copper-Silver Alloys."

Owen, Professor E. A. and **John Iball:** "An X-Ray Investigation of Certain Copper-Tin Alloys."

Allen, N. P., and **S. M. Puddephat:** "Observations of the Porosity and Segregation of Two Bronze Ingots."

Lewis, K. G., and **U. R. Evans:** "Corrosion Below Discontinuous Oxide Coatings, with Special Reference to Magnesium."

Cook, Maurice: "Metal Losses in Melting Brass and Other Copper Alloys."

Hanson, Professor D., and **M. A. Wheeler:** "The Properties of Some Special Bronzes."

Jenkins, C. H. M., and **E. H. Bucknall:** "The Inter-Relation of Age-Hardening and Creep Performance. Part I.—The Age-Hardening of Nickel-Silicon-Copper Alloys." With an Appendix on the Relationship of Time, Temperature, and Concentration as Factors in Age-Hardening by **E. H. Bucknall** and **C. H. M. Jenkins.**

Owen, Professor E. A., and **I. G. Edmunds:** "The Determination of Certain Phase Boundaries in the Silver-Zinc Thermal Diagram by X-Ray Analysis."

Caplan, M. C.: "Note on the Failure of a Gold Fuse in Contact with Nickel-Chromium Alloy."

Rees, R. W.: "Production of Powdered Alloys of Low Melting Point."

Sutton, H., and **L. F. Le Brocq:** "The Protection of Magnesium Alloys Against Corrosion."

Tapsell, H. J., and **A. E. Johnson:** "An Investigation of the Nature of Creep Under Stresses Produced by Pure Flexure."

Haughton, J. L., and **R. J. M. Payne:** "Alloys of Magnesium. Part III.—Constitution of the Magnesium-Rich Alloys Containing Aluminum and Cadmium."

Hopkins, H. G.: "Electron Diffraction Examination of Protective Films Deposited on Magnesium and Magnesium Alloys by the R.A.E. Dichromate Process."

O'Neill, Hugh, and **G. F. Farnham:** "Note on the Tarnishing of Liquid Metals as Studied by X-Rays."

Personals

Charles S. Taylor

Charles S. Taylor, president and treasurer of the Boston Nickel Plating Company, 160 Portland Street, Boston, Mass., is known to be the dean of the jobbing electroplaters in the United States. He has the enviable record of having been with his company continuously for 65 years.

Mr. Taylor began working on October 17, 1870 for the Boston Nickel Plating Company as an errand boy and shop helper. He later became the plater for his concern, then the superintendent. After some years, he purchased a third interest in the company. This was later increased to two-thirds and finally Mr. Taylor became the sole owner.

CHARLES S. TAYLOR

In 1909, the company was incorporated with Mr. Taylor as president and treasurer, and Charles F. Campbell as vice-president and superintendent. In the early days of Mr. Taylor's plating experience, he was associated with Dr. Isaac Adams, George D. Allen and A. N. Clark, the pioneers in the electroplating industry in the United States. At that time the shop was licensed by the United Nickel Company.

Mr. Taylor is a native of Medford, Mass., having been born in that city June 18, 1856, and living there almost all of his life. He has always taken an active part in city affairs, serving two years on the School Committee, one year on the Board of Aldermen, and four years as Mayor of Medford.

At the present time, although Mr. Taylor is past his 79th birthday, he is still active in the Boston Nickel Plating Co. as well as in the Medford Co-operative Bank, of which he is president.

P. J. Potter, formerly second vice-president, was elected a director and vice-president of the Pangborn Corporation, Hagerstown, Md. Mr. Potter will be directly responsible for engineering, sales and production. He has been with the Corporation for 20 years.

Victor F. Stine has been appointed sales manager of the Pangborn Corporation, Hagerstown, Md. Mr. Stine has been with the Corporation for 23 years.

Wiser Brown has been named plant manager of the United States Aluminum Company, Fairfield, Conn., to succeed the late Sidney K. Becker.

Manly M. Windsor is now associated with Harshaw Chemical Company, Cleveland, Ohio, doing plant development work at the Elyria plant. Mr. Windsor was formerly an instructor in the department of chemistry at Massachusetts Institute of Technology.

Wilfred S. McKeon ("Liquid Sulphur Mac") of the Sulphur Products Company, Greensburg, Pa., has been elected president of the Greensburg Advertising Club.

C. B. Schneible, formerly in charge of Chicago district sales for the American Foundry Equipment Company, Mishawaka, Ind., is now devoting his entire time to the sale of the wet dust collectors of his own design.

E. B. Rich has been placed in charge of the Chicago office of the American Foundry Equipment Company, with territory extending from Minneapolis to St. Louis. Mr. Rich has been with the American Foundry Company for some time in engineering, manufacturing and sales work. For the past 16 months he has been working with Mr. Schneible in Chicago territory. His headquarters are at 605 W. Washington Boulevard.

John C. Williams, 208 Architect Building, 415 Brainard Street, Detroit, Mich., will act as representative and distributor in the state of Michigan for buffs and polishing wheels of E. Reed Burns Manufacturing Corporation, 27 Jackson Street, Brooklyn, N. Y.

Obituaries

Charles S. Barbour Jr.

Charles S. Barbour Jr., died on Saturday, June 29, over 60 years of age. Mr. Barbour had spent his whole life in the plating industry, having learned the trade from his father who was also a plater, in the Barbour Silver Company of Hartford, Conn. He was known to be a proficient worker, always in advance of his times. He did more than perhaps any other man in introducing the recording ammeter for obtaining definite weights of deposited metal. He was a pioneer in the reproduction work, known as Dutch Silver. This work required special skill in copper plating on gelatin molds.

Mr. Barbour was one of the original workers in the United States Bureau of Engraving and Printing. He assisted in developing the alternate layers of copper-nickel deposits for the plates for printing currency.

Mr. Barbour was later identified with several concerns in manufacturing and selling, directly or indirectly connected with the electroplating industry. He leaves a widow and one son.

J. F. Newman

J. F. Newman, died suddenly on July 14, aged 55 years. Mr. Newman was president of the Lawrenceville Bronze Company, Pittsburgh, Pa.

Industrial and Financial News

Metal Developments

At a recent meeting of the Board of Directors of the **Foundry Equipment Manufacturers' Association,** 1213 W. Third Street, Cleveland, Ohio, this body recommended that all members of the foundry equipment manufacturing industry maintain the working hours, payment of wage rates, including overtime rate, prohibition of child labor and other labor provisions of the N. R. A. code of the industry.

The agreement for the sale of property and business of the **Baltimore Tube Company, Baltimore, Md.,** to **Revere Copper and Brass Company, Inc.,** New York, has been authorized by the directors of both companies. This agreement is subject to approval by the stockholders of the tube company. According to the announcement, the price to be paid for the tube company is $1,155,000, leaving a net of about $64 per share of preferred stock. Common stockholders have been made an offer of $4.00 per share.

Copper and copper alloys will have a prominent place in the rehabilitation of one of New York City's most historic districts. The 7th Ward, sometimes known as Corlears Hook will be cleared of its ramshackle tenements and dilapidated buildings to make room for a new housing project. Considerable copper and brass will be used in the plumbing and piping systems.

Reynolds Metal bags are now being used for potato chips by the G & G Potato Chip Company of Cohoes, N. Y.

Cast aluminum crankcases supplied with cooling fins were recently recommended by **Charles B. Bohn,** president of the Bohn Aluminum & Brass Corporation for use in low priced cars, in order that the motors could be operated at lower temperatures to increase their life and improve their operating efficiency.

The fact that **Monel metal** containing small percentage of aluminum is non-magnetic is one reason for the increased use of this alloy for airplane parts which placed are near compasses.

Rhodium plated reflectors are gaining in popularity for lighting store windows because, among other reasons they give a "true daylight." Rhodium, it is stated, is also unaffected by heat and does not tarnish. The 60-inch reflectors used by the U. S. Government for coast defense work are copper-rhodium plated.

Separation of Monel metal from steel rivets was ingeniously solved by one manufacturer. Making use of the peculiar property of Monel that it loses its magnetic qualities at about 200 deg. F., he heated the rivets and then separated them easily with a magnetic separator.

The **Brooklyn Technical High** School, Flatbush Avenue, Brooklyn, N. Y., recently accepted the largested shipment of scientific instruments ever made to a technical high school in the United States. These instruments shipment included two large photo-micrographic outfits costing over $2,000 each.

Business Items-Verified

Luminite Products Corporation, Salamanca, N. Y., manufacturer of special castings, printers' rollers and kindred specialties, has let general contract for a one-story addition. Cost, close to $35,000 with equipment. This firm operates the following departments: brass, bronze and aluminum foundry; brass machine shop.

The brass foundry of the **Blake Specialty Company,** Rock Island, Ill., recently was slightly damaged by fire. The damage amounted to $600.00, and was put back in shape within a week, for full production. This firm operates the following departments: bronze, brass and aluminum foundry; brass machine shop; polishing; grinding room.

Davis Welding Company plant, 3400 Beekman Street, Cincinnati, Ohio, was acquired recently by **Fox Company,** Cincinnati. The Fox Company will erect a one-story addition for offices on one end of the plant, and a 50-ft. building extension to be constructed on the other end. The company will occupy the plant September first. The Fox Company manufactures metal specialties.

New Art Plating Company, New York City and others, engaged in the manufacture of silverware have been directed by the Federal Trade Commission to discontinue using or abetting the use of the English hallmark or any imitation thereof to stamp silverware that has not been manufactured in England, and has not met the standards prescribed for the use of the English hallmark by Goldsmiths Hall of England.

Master Eectro-Platers' Institute of the United States moved from its location on East Jefferson, Detroit, Mich., on July 6, to 7320 Hamilton, Detroit, Mich.

Mueller Brass Company, Port Huron, Mich., is being sought by outside interests. Officials of Chase Brass Corporation of Waterbury, Conn., conferred with the company recently, it has been stated.

A new school for welding operators has been opened in Hoboken, N. J., under the supervision of **William Bozman,** eastern service manager for the **Harnischfeger Corporation,** Milwaukee, Wis. Although this new school offers a complete course in all types of ferrous and non-ferrous welding, it is also maintained as a clinic where P&H-Hanson operators may bring any specific problems without charge for instruction.

Corporation Earnings

Net profit unless followed by (L) which is loss.

	1935	1934
American Metal Company Ltd. (First Half)	$285,884	$214,194 (L)
Anaconda Copper Mining Company (First Quarter)	2,350,721	1,636,468
Baltimore Tube Company (First Quarter)	14,107	21,587 (L)
Bohn Aluminum & Brass Corporation (First Half)	952,819	1,138,019
Bridgeport Brass Company (First Half)	374,842	306,669
Cleveland Graphite Bronze Company (First Half)	936,490	......
Doehler Die Casting Company (First Half)	360,706	......
International Nickel Company (First Quarter)	4,917,627	5,049,276
E. I. du Pont de Nemours & Company (First Half)	22,450,485	23,553,598
General Cable Corporation (First Half)	100,096 (L)	240,007 (L)
National Lead Company (First Half)	2,615,510	2,066,755
Yale & Towne Manufacturing Company (First Quarter)	9,676 (L)	21,254

News From Metal Industry Correspondents

New England States

Waterbury, Connecticut

August 1, 1935.

Chase Companies, Inc. have completed negotiations for the acquisition of 51 per cent of the stock of the **Mueller Brass Company** of Detroit, Mich. This is the amount held by the Mueller family, headed by President Mueller of the concern. The concern's sales in 1934 were reported to be $3,500,000 and sales this year are reported to be considerably ahead of last year's.

Products include forgings, castings, rods, tubing, valves, fittings and screw machine products. In addition the Mueller Brass Co. holds patents for making copper joints and has granted 41 licenses under these patents. The funded debt of the company is about $630,000, consisting of first mortgage 7's due 1938-1942 ahead of 216,000 shares of common stock. As of Nov., 1934, the company had assets of $2,969,244 and on Feb. 1 of this year it had 996 employees.

The Shoe Hardware Company of this city, a subsidiary of the **United Rubber Company,** denies reports that the business will be moved to Naugatuck, Conn., where most of the activities of the parent company are now centered. Its officials state that the very fact that it is so busy is ample verification of the denial. It now employs three 8-hour shifts in continuous operations because of the heavy orders for shoe machinery both from the parent company and others.

Chase Companies, Inc. submitted a bid of 8.175 cents a pound for 1,500,000 pounds of copper, asked by the Navy Department last month. The contract went to the **International Mineral & Metals Co.** for 8.08 cents a pound. The **Nassau Refining & Smelting Company** also bid the same as the local concern. The local concern also bid on a contract for 100,000 pounds offered by the Navy but the contract went to the **Nassau Refining & Smelting Company.** All the concerns competing for the latter contract bid the same, 8.05 per pound so the choice was made by lot.

Leon H. French, vice-president of the **French Manufacturing Company,** now owned by the **American Brass Company,** is one of the four new directors of the local Chamber of Commerce, elected last month.—W. R. B.

Connecticut Notes

August 1, 1935.

Plans are being made by the Manufacturers Association of the state for an industrial exposition at Hartford in October as part of the state's Tercentenary Celebration. Exhibits of every kind connected with the brass industry will be displayed. Committee chairmen of every line of industry in the state have been appointed to arrange for the exhibits, among them being:

Brass and non-ferrous products, **John H. Goss of the Scoville Manufacturing Company,** Waterbury; castings, forgings and stampings in non-ferrous metals, **Carl Neuman, Union Manufacturing Company,** Unionville; clocks and timepieces, **Dudley S. Ingraham** of the **Ingraham Clock Company,** Bristol; garment hardware and findings, **E. M. Holmes, North & Judd Manufacturing Company, New Britain;** electrical products, assemblies and parts, **Frank W. Hall, General Electric Company,** Bridgeport; guns and firearms, **Edwin Pugsley, Winchester Arms Company,** New Haven; hardware, producers and consumers, **Carl H. Baldwin, American Hardware Company,** New Britain; recording and measuring instruments, **Howard H. Bristol, Bristol Company,** Waterbury; silverware and cutlery, **E. C. Stevens, International Silver Company,** Meriden.

HARTFORD—In the 43 largest plants the employment figure for June was 23,008, an increase of 168 over the previous month. Increase in man hours was 55,278.

The **Rockwell Products Company** has been organized in this city to manufacture automotive parts. It has an authorized capital of $1,000,000 of which 1,050 was paid in at the start. The officers are: President, **Charles W. Deeds,** also president of the **United Aircraft Export Corporation;** vice-president, **Edward A. Rockwell,** inventor of some of the products; secretary-treasurer, **E. L. Morgan,** who is secretary-treasurer of **Pratt & Whitney.** The directors include the above and **Clayton R. Burt,** president of **Pratt & Whitney, Charles K. Seymour,** president of **Niles-Bemont-Pond** and **J. B. Hayward,** a New York patent attorney. **Mr. Rockwell** is a nephew of the late **Albert F. Rockwell,** one of the founders of the **New Departure Company,** and has sold many of his inventions to the **Stewart-Warner Company** and **General Motors.**

NEW BRITAIN—In the 21 largest plants, the employment figure for June was 12,863, an increase of 22 over May. Man hours increased 44,703.

Landers, Frary & Clark have started construction of a brick and concrete addition, 125 feet long and 100 feet wide. The cost is estimated at $50,000. The company has moved the equipment of its pocket-knife branch from the former **Humason & Beckley** plant to the main plant on East Main Street.

The **Fafnir Bearing Company** is planning to build a modernly equipped forge shop, 74 by 112 feet.

The **Wiremold Company** plans erection of a factory and office building, 90 by 138 feet, three stories high, and a two story building 60 by 70 feet.

BRIDGEPORT—The **General Electric Company** plant here was inspected last month by representatives of the International General Electric Company. The representatives were from 25 different countries. Particular attention was paid to the new electric radios using metal tubes.

Remington Arms Company has made a gift of $30,000 to the **Bureau of Biological Survey** of the **U. S. Department of Agriculture** for the establishment of educational courses in wild game management in state institutions.

BRISTOL—The 12 largest plants here reported total employees in June of 9,341, an increase of 166 over the previous month. Total man hours were 1,474,910, an increase of 43,522.

The **Remington Arms Company** branch here, formerly the **Parker Gun Company,** closed for a week last month and all employees received pay for the week. Salaried employees had two weeks off with pay. **Bradley & Hubbard** closed for a week. The **International Silver Company, New Departure, General Electric Company** and **Manning & Bowman** plants closed for two weeks.

THOMASTON—The **Seth Thomas Clock Company** and the **Plume & Atwood Manufacturing Company** plants here were closed for 10 days the first part of last month.

COLLINSVILLE—The **Collins Company** earnings after adjustments and charges and after reserves for federal taxes and other accruing liabilities were $139,549 for the year ending May 31. The company's export business showed the same improvement it did the previous year. The regular quarterly dividend of $1.50 a share was ordered paid July 15. Total assets are given as $2,600,204, an increase of $133,000. The surplus is now $1,061,000, an increase of $65,000.—W. R. B.

Providence, R. I.

August 1, 1935.

Total payroll distribution in the various manufacturing industries of Rhode Island during the month of June was $7,807,856 according to statistics of the Brown Bureau of Business Research. This is a loss of 4.3 per cent from the total for May, but a gain of 5.7 per cent as compared with the corresponding month in 1934. The non-ferrous metal trades showed a total of $149,163, an increase of 18.2 per cent over May of this year and of 14.6 per cent as compared with June, 1934. The manufacturing jewelry and silverware industries aggregated a payroll distribution amounting to $739,832 during June, a decrease of 5 per cent as compared with the preceding month, but an increase of 6.8 per cent as compared with June of a year ago.

D. M. Watkins Company of this city has announced the recent election of the following officers: President, **Frederick M. Watkins;** Treasurer and General

Manager, **Mrs. Velena B. Watkins** and secretary, **M. S. Watkins.**

The Ulite Manufacturing Company has removed its factory and offices from 59 Page Street to larger quarters in the Waite-Thresher building, 46 Chestnut Street.

The Rhode Island Manufacturing Company of 185 Eddy Street, has removed to more commodious quarters in the Waite-Thresher building, 10 Abbott Place entrance.

The **Pawtucket Central Purchasing Board** has awarded contracts to the **United States Pipe and Foundry Company,** Boston, for 3,600 feet of lead pipe at $45.50 a ton and the **Grinnell Company,** of Providence, 3,000 feet of one-inch lead pipe at 34 cents per foot and 200 feet of two-inch lead pipe at 76 cents per foot.

George A. Orton, 113 Regent Avenue, has filed his statement at the City Clerk's office that he is sole owner of the **Providence Welding Company,** rear of 43 Chambers Street.

A certificate of incorporation as a manufacturing jewelry concern has been filed at the office of the Secretary of State by the **A. H. Garst Company, Inc.** of Providence. The authorized capital is given as 100 shares of common stock of no par value. The incorporators are **Arthur H. Garst, M. E. Olmstead** and **Bernard B. Aberdon,** all of Providence.

Arthur J. Levy of Cranston, **Charles C. Remington** of Providence and **Frank F. Pinkos** of Warwick have incorporated the **Rhode Island Jewelry Company** to conduct a manufacturing jewelry business in Providence with an authorized capital consisting of 100 shares of common no par value stock.

W. H. M.

Middle Atlantic States

Utica, N. Y.

August 1, 1935.

Enlargement of the **International Heater Company** line at Utica, N. Y., is announced by its officials. The company expects by fall to be prepared to make any type of heating and air conditioning system a home owner wants for any type of fuel he cares to use. Different units will be built for oil, coke, coal or gas. In addition to its established line the company is now making a new oil boiler. It is employing approximately 500 men. Officials report the concern is enjoying an export business with China and South America.

The **Utica Plumbing Supply Company** with assets of $172,514 has applied in Federal Court for permission to re-organize under the bankruptcy act.

The plan of re-organization of the **Rome Company, Inc.,** Rome, on file July 29 in Federal Court in Utica calls for an exchange of debentures and stock for the principal claims. The makers of beds and metal novelties would permit creditors with claims of less than $500 to take 30 cents on the dollar or they may take non-interest bearing notes to the extent of 50 per cent of the claim. The new company it is estimated would have $430,000 in new debentures, $18,500 in non-interest notes and 145,000 shares of common stock outstanding under the plan.

Under its plan of re-organization the **Bossert Corporation,** Utica, will be named the **Bossert Company.** The plan has been approved by the Federal Court. **Peter Guido,** assistant treasurer, detailed these claims filed by creditors as of April 25: priority claims, $6,629.29; secured claims, $129,485.23; unsecured claims, $295,064.02 and contingent claims, $117,-978.17. Holders of unsecured and contingent claims after receiving payment of 45 per cent have been given alternate plans for payment of the balance. Under plan A they would receive 75 per cent of the balance in cash but the majority chose plan B under which they will received five year 6 per cent debenture for full balance due.—E. K. B.

Newark, N. J.

August 1, 1935.

The **Tung Sol Lamp Company,** 96 Eighth Avenue, has purchased the plant of the **Banister Shoe Company,** on Orange Street and will hereafter operate two plants. The plant is a four-story one. The **Tung Sol Company,** has offices at 1775 Broadway, New York, will reconstruct the Orange Street plant at a cost of $28,500.

The **Chron-Art Electrical Manufacturing Corporation,** makers of precious electrical equipment, has leased a building on Hoyt Street and will move there after alterations have been made. The **Westinghouse Lamp Company,** Bloomfield, has been awarded a certificate of merit by the **Newark Safety Council** for operating its miniature lamp departments without lost time or disabling accident for sixteen months. The record was unbroken to the time of the award. Other divisions of the lamp company engaged in heavier work have received similar awards.

Following Newark concerns have been incorporated: **Home Utilities Company, Inc.,** electrical and heating appliances, $50,000; **Hydrogenation Products Corporation,** chemicals, 20,000 shares, no par.—C. A. L.

Trenton, N. J.

August 1, 1935.

Harry B. Landolt, former purchasing agent of the **Westinghouse Lamp Company,** Trenton, has been appointed purchasing agent of the City of Trenton. He was connected with the lamp company for some time.

Factory payrolls in New Jersey showed a slight increase during May and a slight decrease in employment, according to the State Labor Department. The payrolls advanced to $4,807,686. Trenton metal industry plants report they are holding their own during the summer months.

Following concerns have been chartered here: **Shef Manufacturing Company,** chemicals, Union City, 100 shares, no par; **Dermal Chemical Company,** Jersey City, $10,000.—C. A. L.

Middle Western States

Toledo, Ohio

August 1, 1935.

Toledo and environs are experiencing the usual mid-summer dull period. Most of the motor accessory plants are low in production but an early fall resumption is expected. The plating plants also are more or less quiet.

This area has been rather hard-hit during the last several weeks. Much of the trouble was due to labor disputes which, for a time, seemed to have no end. Many plants engaged on automobile work were under reduced production owing to lack of electric power, at a time when they should have been most active. All this now seems to have been settled and Toledo once more faces more favorable conditions.

Manufacturers, particularly those engaged in the motor car accessory industry, are making preparations through plant improvement, for a busy fall.

Continued operation of the **Willys-Overland** plant was assured on July 13, when announcement was made that bondholders, creditors and the trustee, the National City Bank of New York, had reached an agreement on a new request for permission to manufacture 10,000 Willys' 77's and trucks. The application was filed immediately and means not only the re-employment for the present force of about 1,500 workers, but an increase later to 3,000. The program will carry the plant on a basis of 3,000 employees to about Nov. 1, it is stated.—F. J. H.

Detroit, Mich.

August 1, 1935.

In spite of the fact it is mid-summer, industrial conditions are holding up remarkably well. While many of the big non-ferrous metal plants are curtailing, none are nearly so low in production as they were a year ago. Furthermore it looks as if the fall revival would be much earlier than usual. Preparations for this already are under way in many of the big motor car plants. Executives are taking their vacations now and talking about getting back on the job by Sept. 1. It is expected the new models will be shown two months earlier than in other years.

Accessory manufacturers are preparing accordingly. So it would seem the annual mid-summer dull period in this area will be much shorter than usual. Furthermore it is apparent that the coming peak in motor car manufacturing will be leveled off so as to reduce to a minimum a long period of inactivity.

Manufacturers of refrigeration units are about as active as they were earlier

in the season. No signs of curtailed production is in sight, and most of the plants are working to capacity.

The plating industry naturally is not as active as it was a few weeks ago. But this is believed only a temporary condition.

Manufacturers of plumbing supplies are a little more active.

The sale of two million pounds of Dow metal to European interests within the last few months, was revealed on July 11 in the report of **President William H. Dow,** at the stockholders annual meeting. No one appeared to know what the metal was being used for, but some believe it is going into airplanes. This transaction and the domestic demand, which is up 40 per cent, nearly doubled the sale of this metal during the past year. Employment is at an all-time peak, with a total of 3,000 at work.

O. B. Mueller, president of the **Mueller Brass Company,** Port Huron, confirmed reports on July 10 that a controlling interest in the company is being sought by the **Chase Brass Corporation,** of Waterbury, Conn. Officials of the two organizations were in conference on that date. The **Mueller Brass Company** is now employing approximately 1,000 persons.

Owing to a largely increased volume of its automobile radiator business, the **McCord Radiator & Manufacturing Company,** Detroit, turned the half year with production maintained at near spring peak levels. Number of employees have increased 10 per cent since May.

Fine reports come from the **Mid-West Abrasive Company,** through its president, **J. T. Jackson.** The organization expects a heavy demand for its newly developed wet abrasive line, which has a particular appeal to the motor car industry.

The approach of the motor car industry's production of models for 1936, has speeded activities at the plant of the **Taylor-Winfield Corporation,** 14307 Third Avenue, Highland Park, according to **Walter A. Anderson,** vice-president. This factory has been operating continuously since its establishment more than a year ago. Most of its output goes to automobile manufacturers. In addition to new machines in process of manufacture, this company has considerable rebuilding work on hand in modernizing equipment which has become obsolete through new body design and methods of construction. Most grades of aluminum and duralumin used in the motor car industry may readily be welded on the special Taylor-Winfield equipment, it is stated.—F. J. H.

Chicago, Ill.

August 1, 1935.

Indications that a definite increase in business is expected shortly is seen in a large number of plant expansions among manufacturers of articles in the non-ferrous metal field. New products and enlarged advertising appropriations are other straws in the wind.

S. Buchsbaum & Company, manufacturers of jewelry since 1888, have begun work on a one-story 125 x 100 foot addition to their plant at 243 East Huron Street. The $46,000 annex, scheduled for completion by September 1, will permit a bigger precious metal division according to **Herbert J. Buchsbaum,** president.

E. Edelmann & Company, automobile accessory manufacturers, will build a $75,000 addition in the rear of the present structure at 2332 Logan Boulevard, providing approximately 25,000 square feet of additional floor space. The front elevation of the present plant will be modernized with metal and structural glass.

The **Aeriet Air Conditioner Company** has been acquired by **Vincent Bendix,** chairman of the **Automatic Products Corporation** in exchange for stock. The new concern has acquired the individual room control system developed by the **Super-Diesel Corporation** of La Porte, Ind.

A new modern type heat circulator, a combination gas and coal range, and a new furnace heat regulator will be introduced shortly by the **Kalamazoo Stove Company,** Kalamazoo, Mich.

John Berg, 69, former president of the **Metal Specialties Manufacturing Company** and for nearly half a century a manufacturer here, died recently of a cerebral hemorrhage.

Among Chicago radio manufacturers who will bring out sets utilizing the metal tube are **Stewart-Warner-Alemite Corporation,** makers of Stewart-Warner radios, and **General Household Utilities Company,** headed by **William Grunow.**

The **Muter Company,** manufacturers of radio and electrical specialties and humidifying equipment, will launch a consumer advertising campaign in the fall.

Counter freezer sales of the **Bastian-Blessing Company** for the past three months have doubled those of the corresponding period of last year, according to **M. E. Stevzynski,** advertising manager. This increase has been enjoyed in spite of a rise in price effective April 20. Approximately 60 per cent of the sales are in towns under 10,000, a sales check shows.

Metal furniture was prominently displayed at the recent semi-annual furniture shows here at the **American Furniture Mart** and the **Merchandise Mart,** and proved popular with the 6,000 furniture buyers who attended the trade shows. Manufacturers of electrical appliances were also represented with exhibits. The official opening of the **American Furniture Mart** show took place in the display room of the **Rembrandt Lamp Corporation,** said to be the first air-conditioned showroom in America.—R. G. K.

Pacific States

Los Angeles, Calif.

August 1, 1935.

North American Aviation, Inc., will spend several hundred thousand dollars to build an aviation plant at Mines Field here and employ 500 to 1,000 men. This concern is an affiliate of General Motors.

The **Magnus Company** are building a $90,000 foundry on Riverside Drive, to produce all non-ferrous metals.

C. C. Crockett will establish at the Grand Central Air Terminal, Glendale, a plant to make aeronautical instruments.

The **P & R Development Company** of 727 East 62d St., has been organized to recover the tin and the steel base of tin cans. **C. N. Rosenthal** is president and **David E. Delape** of Pasadena is the inventor. The tin cans are shredded, put in chemical mixture, the tin is drawn into vats and recovered in metallic form by electrolysis and the steel to be used over again.

The **U. S. Spring & Bumper Company** have two large plants here at 50th and Magnolia and at 1120 South Los Angeles St. All wages have been raised voluntarily over the past code requirements. Business has greatly improved and both plants have been enlarged, the plating plant doubled, new testing laboratory, new motors and very large generators put in. They have a large output in springs and the new **U. S. Tuthill** safety highway guard rail, which absorbs the shock of a car or truck which run against it. They also make a complete line of farm tools.

The **Nelli Art Foundry Company** at 2213 Garnet St., **Guido Nelli** at the head, have been making a specialty of bronze statues for parks in the cities all over the country.

The **Kim Manufacturing Company** are now making a new portable electric light fixture. The light comes from the car battery, truck or any outdoor station, for country districts.—H. S.

North Pacific

August 1, 1935.

Announcement has been made that the **Farnsworth Television Corporation** of San Francisco have brought television down to a practical and commercial basis, by the cold cathode process; sets to cost $90.00. It was invented by Philo Farnsworth. Equipment will be made here and at Philadelphia, the latter place by the Philadelphia Storage Battery Co., in England by **Baird Television,** Inc., of London, in Central Europe by **Fernseh Aktiengesellschaft** of Germany. In San Francisco the equipment will be made by **Heintz & Kaufman,** an affiliate of the **Dollar Steamship Company.**

The **Bright Star Battery Company** of 383 Brannan St., San Francisco, have appointed **Haywood H. Hunter** of Los Angeles as their southern California representative.

Stirm & Klenck of 980 Folsom St., San Francisco, have spent $5,000 in enlarging their sheet metal shop.

The **Doran Company** of 75 Horton St., Seattle, are making a new style thermostatic safety shower bath.—H. S.

Metal Market Review

August 1, 1935.

Copper was firm all through the month at 8c. Immediately after the sudden fall from 9c the metal steadied and sales were made in good volume. About the middle of the month buying became very heavy and although this volume did not last more than a few days, it was followed by a steady call with a firm undertone.

The only unsettling feature is the foreign situation, but the domestic metal seems to be on solid ground at this time, even though the London market is a little lower.

Zinc was unchanged at 4.30 for Prime Western, East St. Louis, until the last week when it advanced to 4.40. Sales were active at first, then fair, then in the middle of the month, dull; but this dull spell was followed by considerable activity and strong demand from the galvanizers, which resulted in the increased price. Sales at this time are smaller.

World production of zinc during the first half of 1935 was about 15 per cent ahead of the same period in 1934, according to the American Bureau of Metal Statistics.

Tin was quiet but firm, beginning the month at 51.75 and closing at 52.65, almost the high for the month. Buying was fairly active at first, became a little dull later, suffered a little agitation during the third week due to speculative manipulation in London, and closed with spot tin somewhat scarce and conditions unsettled.

Lead was firm throughout, rising from 3.85c to 4.00c, St. Louis. Sales during the first week were 12,000 tons, a high mark, after which the price was advanced to 4.00c. This was followed by quieter demand with the price still firm and sales moderate.

Aluminum and **Nickel** were as usual, unchanged at 22c and 35c respectively.

Antimony was unchanged at its "pegged" price of $12.75.

Silver made a new record for itself. Beginning the month at 69.75 it slid gently down to 67.75 in two weeks and since then has remained unchanged at that figure, an unprecedented performance for this volatile metal. The slump was caused by small demand at the beginning, followed by active selling in India and China. The situation threatened to become disorderly but it was taken in hand by the U. S. Treasury whose purchases steadied the market. At the close, conditions were dull with no prospect of immediate changes, due largely to the absence of sellers.

Platinum was unmoved at $30 per ounce. **Gold** was also fixed (at the same Treasury price) $35 per ounce.

Scrap Metals were active to strong. Copper refiners raised their bids 10 to 15 points early in the month but offerings were rather light. About the middle of the month these bids were raised again ⅛ to ¼ cent, with offerings a little freer because of a break in London prices. Thereafter the increased prices held although demand became quieter at the end of the month. Bids were edging up slightly as offerings continued to be limited.

The combined deliveries of brass and bronze ingots and billets by the members of the Non-Ferrous Ingot Metal Institute for the month of June, 1935, amounted to a total of 4,111 tons.

Average prices per pound received on commercial grades of six principal mixtures of ingot brass during the twenty-eight-day period ending July 12:

Commercial 80-10-10 (1½% Impurities)	9.489c.
Commercial 78% Metal	7.016c
Commercial 81% Metal	7.288c
Commercial 83% Metal	7.536c
Commercial 85-5-5-5	7.882c
Commercial No. 1 Yellow Brass Ingot	6.192c

Wrought Metal Market

Activities among the mills were about the same as in the past month or perhaps a little better judging from employment records and general index figures. A leading distributor reports that July was about 10 per cent above July, 1934; that the first six months of 1935 were about 15 per cent ahead of the same period in 1934, and that July, 1935 was about 7 per cent under June, 1935, a seasonal decrease.

Daily Metal Prices for July, 1935

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	4*	5	8	9	10	11	12	15	16	17
Copper c/lb. Duty 4 c/lb.													
Lake (del. Conn. Producers' Prices)	8.125	8.125	8.125	...	8.125	8.125	8.125	8.125	8.125	8.125	8.125	8.125	8.125
Electrolytic (del. Conn. Producers' Prices)	8.00	8.00	8.00	...	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Casting (f.o.b. ref.)	7.25	7.25	7.50	...	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50
Zinc (f.o.b. East St. Louis) c/lb. Duty 1¾ c/lb.													
Prime Western (for Brass Special add 0.05)	4.30	4.30	4.30	...	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30
Tin (f.o.b. N. Y.) c/lb. Duty Free, Straits	51.75	51.85	51.90	...	51.90	52.20	52.15	52.15	52.125	52.05	52.25	52.35	52.50
Lead (f.o.b. St. L.) c/lb. Duty 2⅛ c/lb.	3.85	3.85	3.85	...	3.90	3.95	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Aluminum c/lb. Duty 4 c/lb.	22.00	22.00	22.00	...	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Nickel c/lb. Duty 3 c/lb.													
Electrolytic 99.9%	35.00	35.00	35.00	...	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Antimony (Ch.99%) c/lb. Duty 2 c/lb.	12.75	12.75	12.75	...	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75
Silver c/oz. Troy, Duty Free	69.75	69.50	69.375	...	69.00	68.25	68.125	68.75	69.375	68.75	67.75	67.75	67.75
Platinum $/oz. Troy, Duty Free	30.00	30.00	30.00	...	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Gold—Official Price[1] $/oz. Troy	35.00	35.00	35.00	...	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00

	18	19	22	23	24	25	26	29	30	31	High	Low	Aver.
Copper c/lb. Duty 4 c/lb.													
Lake (del. Conn. Producers' Prices)	8.125	8.125	8.125	8.125	8.125	8.125	8.125	8.125	8.125	8.125	8.125	8.125	8.125
Electrolytic (del. Conn. Producers' Prices)	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Casting (f.o.b. ref.)	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.25	7.477
Zinc (f.o.b. East St. Louis) c/lb. Duty 1¾ c/lb.													
Prime Western (for Brass Special add 0.05)	4.30	4.30	4.30	4.30	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.30	4.326
Tin (f.o.b. N. Y.) c/lb. Duty Free, Straits	52.45	52.55	52.75	52.45	52.50	52.00	52.375	52.70	52.70	52.65	52.75	51.75	52.286
Lead (f.o.b. St. L.) c/lb. Duty 2⅛ c/lb.	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.85	3.973
Aluminum c/lb. Duty 4 c/lb.	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00	22.00
Nickel c/lb. Duty 3 c/lb.													
Electrolytic 99.9%	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Antimony (Ch.99%) c/lb. Duty 2 c/lb.	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75	12.75
Silver c/oz. Troy, Duty Free	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	67.75	69.75	67.75	68.216
Platinum $/oz. Troy, Duty Free	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Gold—Official Price[1] $/oz. Troy	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00

[1] U. S. Treasury price. *Holiday.

Metal Prices, August 1, 1935

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 8.125, Electrolytic 8.00, Casting, 7.50.
Zinc: Prime Western, 4.40. Brass Special, 4.50.
Tin: Straits 52.625. Pig 99%, 51.70.
Lead: 4.00. **Aluminum,** 22.00. **Antimony,** 12.75.
Nickel: **Shot, 36. Elec., 35.**
Quicksilver: Flasks, 75 lbs., $71.00. **Bismuth,** 90c.
Cadmium, 70c.: **Silver,** Troy oz., official price, N. Y., August 1, 67¾c. **Gold:** Oz. Troy, Official U. S. Treasury price, August 1, **$35.00. Scrap Gold, 6¾c.** per pennyweight per karat, dealers' quotation. **Platinum,** oz. Troy, $30.00.

Duties: Copper, 4c. lb.; zinc, 1¾c. lb.; tin, free, lead, 2⅛c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

INGOT METALS AND ALLOYS

	Cents lb.	U. S. Import Duty	U. S. Import Tax*
Brass Ingots, Yellow	6⅛ to 7⅞	None	4c. lb.[1]
Brass Ingots, Red	8 to 11	do	do
Bronze Ingots	9 to 12¼	do	do
Aluminum Casting Alloys	15½ to 22	4c. lb.	None
Manganese Bronze Castings	20 to 34	45% a. v.	3c. lb.[2]
Manganese Bronze Forgings	26 to 38	do	do
Manganese Bronze Ingots	9 to 13	do	4c. lb.[1]
Manganese Copper, 30%	11½ to 16	25% a. v.	3c. lb.[2]
Monel Metal Shot or Block	28	do	None
Phosphor Bronze Ingots	10 to 12	None	4c. lb.[1]
Phosphor Copper, guaranteed 15%	13¼ to 15	3c. lb.[2]	do
Phosphor Copper, guaranteed 10%	11½ to 14	do	do
Phosphor Tin, no guarantee	61 to 75	None	None
Silicon Copper, 10%	18 to 30	45% a. v.	4c. lb.[1]
Iridium Platinum, 5%	$30.—	None	None
Iridium Platinum, 10%	$31.—	None	None

*Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.
[1]On copper content. [2]On total weight. "a. v." means ad valorem.

OLD METALS

Dealers' buying prices, wholesale quantities:

	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	6⅜ to 6⅝	Free	4c. per pound on copper content.
Light copper	5½ to 5¾	Free	
Heavy yellow brass	3⅜ to 3⅝	Free	
Light brass	3 to 3⅛	Free	
No. 1 composition	4⅞ to 5⅛	Free	
Composition turnings	4⅝ to 4⅞	Free	
Heavy soft lead	3 to 3¼	2⅛c. lb.	None.
Old zinc	2¼ to 2⅜	1½c. lb.	
New zinc clips	2¾ to 3	1½c. lb.	
Aluminum clips (new, soft)	12¼ to 13¼	4c. lb.	
Scrap aluminum, cast	9¼ to 10	4c. lb.	
Aluminum borings—turnings	5 to 5½	4c. lb.	
No. 1 pewter	30 to 32	Free	
Electrotype or stereotype	2⅞ to 3	2⅛c. lb.*	
Nickel anodes	30 to 33	10%	
Nickel clips, new	31 to 33	10%	
Monel scrap	11 to 18½	10% a.v.	

*On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since June 27, 1935. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled	15c.	2½c. lb.
Bare wire, soft, less than carloads	11.75c.	25% a. v.
Seamless tubing	15¼c.	7c. lb.

*Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

BRASS AND BRONZE MATERIAL

	Yellow Brass	Red Brass 80%	Comm'l. Bronze	Duty	
Sheet	13⅝c.	14½c.	15⅛	4c. lb.	U. S. Import Tax 4c. lb. on copper content.
Wire	14⅛c.	15 c.	15⅝	25%	
Rod	12⅛c.	15 c.	15½	4c. lb.	
Angles, channels	21⅝c.	22¾c.	23⅛	12c. lb.	
Seamless tubing	15⅜c.	16 c.	16¾	8c. lb.	
Open seam tubing	21⅝c.	22¾c.	23⅛	20% a. v.	

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal		Wire and Rod	
10% Quality	22⅞c.	10% Quality	25¾c.
15% Quality	25 c.	15% Quality	30⅛c.
18% Quality	26¼c.	18% Quality	33⅜c.

TOBIN BRONZE AND MUNTZ METAL

Net base prices per pound. (Duty 4c. lb.; import tax 4c. lb. on copper content.)

Tobin Bronze Rod	15¾c.
Muntz or Yellow Rectangular and other sheathing	16⅞c.
Muntz or Yellow Metal Rod	13¼c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.80
Aluminum coils, 24 ga., base price, tons lots, per lb.	30.50

ROLLED NICKEL SHEET AND ROD

Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	50c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

MONEL METAL SHEET AND ROD

Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

SILVER SHEET

Rolled sterling silver (August 1) 68½c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.50	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' price)	10.25	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' price)	14.25	2c. lb.
Full Lead Sheet (base price)	7.50	2⅛c. lb.
Cut Lead Sheet (base price)	7.75	2⅛c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty Free)

This list applies to either block tin or No. 1 Brittannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. or over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 308.

Supply Prices, August 1, 1935

ANODES

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 500 lbs. or more, and subject to changes due to fluctuating metal markets.

Copper: Cast	14¾c. per lb.
Electrolytic, full size, 13c. cut to size	13c. per lb.
Rolled oval, straight, 13½c.; curved,	14½c. per lb.
Brass: Cast	13½c. per lb.
Zinc: Cast	.08⅞c. per lb.
Nickel: 90-92%	.45 per lb.
95-97%	.46 per lb.

99%+cast, 47c.; rolled, depolarized, 48.

Silver: Rolled silver anodes .999 fine were quoted August 1, from 71c. per Troy ounce upward, depending upon quantity.

WHITE SPANISH FELT POLISHING WHEELS

Diameter	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	$2.95/lb.	$2.65/lb.	$2.45/lb.
10-12-14 & 16	2 to 3½	2.85	2.55	2.35
6-8 & over 16	1 to 2	3.05	2.75	2.55
6-8 & over 16	2 to 3½	3.00	2.70	2.45
6 to 24	Under ½	4.25	3.95	3.75
6 to 24	½ to 1	3.95	3.65	3.45
6 to 24	Over 3½	3.35	3.05	2.85

Any Quantity

4 to 6	Under ½, $5.00	½-1, $4.85	1 to 3, $4.75
1½ to 4	" 5.55	" 5.40	" 5.35
1 to ½	" 5.85	" 5.70	" 5.60

Extras: 25c per lb. on wheels, 1 to 6 in. diam., over 3 in. thick.
On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

16" 20 ply 84/92 Unbleached	$76.30
14" 20 ply 84/92 Unbleached	58.51
12" 20 ply 84/92 Unbleached	44.01
16" 20 ply 80/92 Unbleached	63.81
14" 20 ply 80/92 Unbleached	49.02
12" 20 ply 80/92 Unbleached	36.96
16" 20 ply 64/68 Unbleached	56.32
14" 20 ply 64/68 Unbleached	43.32
12" 20 ply 64/68 Unbleached	32.72
⅜" Sewed Buffs, per lb., bleached or unbleached	48c. to 1.12

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P.	lb.	.13½-.16
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.05¼-.05¾
Chromic, 400 or 100 lb. drums		.15¾
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.03
Hydrochloric, C. P., 20 deg., carboys	lb.	.06½
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36 deg., carboys	lb.	.05-.06¼
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl, drums	lb.	.13½-.14½
Denatured, drums	gal.	.475-.476
Alum—Lump, barrels	lb.	.03¾-.04
Powdered, barrels	lb.	.0390-.0415
Ammonia, aqua, com'l., 26 deg., drums, carboys	lb.	.02½-.05
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide, technical crystals, kegs	lb.	.55-.58
Arsenic, white kegs	lb.	.04½-.05
Asphaltum, powder, kegs	lb.	.23-.41
Benzol, pure, drums	gal.	.41
Borax, granular, 99½+%, ton lots	lb.	.0245-.0295
Cadmium oxide, 50 to 1,000 lbs.	lb.	.65
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.06
Chrome, Green, commercial, bbls.	lb.	21½-23½
Chromic Sulphate, drums	lb.	.33-.55
Copper—Acetate (Verdigris)	lb.	.21
Carbonate, 53/55% cu., bbls.	lb.	.14½-.16½
Cyanide (100 lb. kgs.)	lb.	.38-.40
Sulphate, tech., crystals, bbls.	lb.	4.55-5c.
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½
Crocus Martis (Iron Oxide) red, tech., kegs.,	lb.	.07
Dextrin, yellow, kegs	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	30.00
Fluorspar, bags	lb.	.03½
*Gold Chloride	oz.	$18¼-23
Gum—Sandarac, prime, bags	lb.	.50
Shellac, various grades and quantities	lb.	.21-.31
Iron Sulphate (Copperas), bbls.	lb.	.01½
Lead—Acetate (Sugar of Lead), bbls.	lb.	.10-.13½
Oxide (Litharge), bbls	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, (Wood Alcohol) 100% synth., drums	gal.	.42½
Nickel—Carbonate, dry, bbls.	lb.	.35-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.13-.14
Salts, double, 425 lb. bbls.	lb.	.13-.14
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.07¼-.08⅝
Potassium—Bichromate, casks (crystals)	lb.	.08⅝
Carbonate, 96-98%	lb.	.07⅝
Cyanide, 165 lbs. cases, 94-96%	lb.	.57½
Gold Cyanide	oz.	$15.45*
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge—Nickel, 100 lb. lots	lb.	.08
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
*Silver—Chloride, dry, 100 oz. lots	oz.	.54⅜*
Cyanide, 100 oz. lots	oz.	.64½
Nitrate, 100 ounce lots	oz.	.46*
Soda Ash, 58%, bbls.	lb.	.0252
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17½-.22
Beryllium fluoride ($2NaF. BeF_2$)	lb.	4.30-7.00
Gold Cyanide	oz.	$17.10*
Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Metasilicate, granular, bbls.	lb.	3.15-3.30
Nitrate, tech., bbls.	lb.	.02¼
Phosphate, tribasic, tech., bbls.	lb.	.0375
Silicate (Water Glass), bbls.	lb.	.01½
Stannate, drums	lb.	.33½-.36½
Sulphocyanide, drums	lb.	.30-.45
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.38½
Tripoli, powdered	lb.	.03
Trisodium Phosphate—see Sodium Phosphate.		
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.11-.12
Cyanide (100 lb. kegs)	lb.	.37
Chloride, drums, bbls.	lb.	.07½-.10
Sulphate, bbls.	lb.	.03-.037

* Gold and silver products subject to fluctuations in metal prices.

METAL INDUSTRY

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